RAILROAD GAZETTE

FRIDAY, JUNE 23, 1893.

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Contributions.

The Buckeye Coupler at the Western Club Tests.

LAKEWOOD, N. Y., June 14, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the report of the tests of car couplers by the Western Railway Club published in your last issue, I note several errors in the column devoted to the number of parts in couplers. The most glaring is that referring to the "Buckeye" coupler (9 parts). This is 50 per cent. more than the entire number of pieces used in its construction and a goodly percentage more than they could make of it after giving it seven blows under the drop. You will oblige by giving this the same publicity as the report. ED. J. EAMES.

[We were bound to accept the official record as furnished for publication.—EDITOR RAILROAD GAZETTE.]

Some Engine Comparisons.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in the June number of the *Master Mechanic* that "The Old Colony compound No. 232, in hauling the 'boat train' between Boston and Fall River, ran 1,908 miles on an average coal consumption of 69 lbs. to the mile. A simple engine, No. 239, in making 360 miles consumed an average of 100 lbs. per mile."

The natural inference that this would carry is that the compound is a very economical machine, even in passenger service. It seems to me to prove only that the Old Colony simple engine is a wasteful one. If you care to turn to Mr. Forsyth's paper before the Western Railway Club, page 94, Engine 145, a simple 19 in. × 24 in., you can easily figure out that she used but 60.5 lbs. of coal per mile. This is the average of five trips with trains of 10 cars. Comparing this with the 69 lbs. burned by compound engine No. 232 shows a saving of 12.3 per cent. in favor of the simple engine. In a mild way, I object on general principles to such comparisons of engines as made in the *Master Mechanic*. For instance: The run of 1,908 miles made by compound engine 232 is compared with a run of only 360 made by simple engine 239, and without any facts as to the weights of the trains hauled, time of year, or even stating that they both hauled the "boat train." I have but little doubt but that the paragraph will be quoted as proving that a well designed compound locomotive will show a decided economy over a simple locomotive, even in passenger service. This evidently is not a just conclusion, except locally.

If I remember correctly, the evaporation of Mr. Dean's compound is only about 5 lbs. of water per pound of coal, but it has been said that the usual evaporation on the Old Colony is about 6 lbs. S. M. P.

Laying out Freight Yards.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your correspondent, "Civil Engineer" (see issue of June 2), along with some of the other civil engineers, is in a measure to blame for the thousands of badly designed freight yards in the United States. I fully concur with "H. D. W." that all freight yards are defective and it is a "sad commentary on the engineering department that designed these yards" by a theory, and lacked that which was most essential, practical experience.

A yard is a collection of tracks, but these tracks must be so arranged as to suit the traffic passing through it. Each yard possesses an individuality of its own. There is no best way, each yard must be planned, built and requires special treatment; the arrangement of tracks in one yard would not suit another yard on the same line. In your issue of June 8, Mr. Morrison comes nearer the mark, when he says, "It cannot be expected that the engineering department should be familiar with all branches of railroading," and implies that the men who use the completed yards are the men to design them.

Up to the present time when a yard is needed on any of our roads we find a civil engineer examining the lay of the land, and after getting the yard located he begins to make his design, which, when completed, is approved of and yard is built. It is then discovered that the scale is not where it should be, that several switches are not where they should be, that tracks are too close, that there is too much delay getting in and out of the yard. After a time it is also found to be entirely too small, and more tracks are put down, the switches are changed, but the inherent radical defects are still there, and are severely let alone. Why? Because it would cost entirely too much to apply the proper remedy. Now, who is at fault? Is it not the civil engineer who designed this yard without consulting the men working on the practical side, who were not civil engineers, but could have given the civil engineer a few pointers as to how to arrange a yard to suit the business at that particular point?

"Civil Engineer" desires plans of ideal freight yards. I do not think any will be submitted from practical railroadmen I fail to see how they could when the needs and requirements are not known to them. They might give you a plan of a yard the requirements of which they are perfectly familiar with, but which would not suit any other road in the Union, and when "Civil Engineer" designs a yard let him not be ashamed to ask some practical man for information who is familiar with what is needed, and which "C. E." may spoil by his theories. He may not be a graduate from some college, but may be able to give him a few practical pointers as to how to lay out a yard "the one best way" for that particular locality. YARDMASTER.

The Fusee Danger Signal Compared with the Torpedo.

TO THE EDITOR OF THE RAILROAD GAZETTE:

During the past winter I was employed on the western division of the Fitchburg Railroad, where the fusee plays a very important part as a night danger signal in the protection of trains. The fusee does this so thoroughly that I believe some facts as to its value, especially when compared with the torpedo, would be of interest to many of your readers.

It is used conjointly with the torpedo, when practicable, but one great advantage it has over its explosive companion is that it can be used at extremely critical times when the other could not, and under all circumstances with more satisfactory results, because it insures greater safety. Compared with the torpedo as a danger signal it is as far superior as is the absolute block to the old manner of train protection. Torpedoes do not indicate the distance or time between the trains. Possibly they may have been placed upon the rail hours before being exploded. They do not attract the attention of the engineman except by their detonation, so that he has no premonition of impending danger until he hears the report. They give absolutely no warning to the men on the rear end of the train. They cannot be applied to the rail unless a man leaves the train to clamp them on, and this frequently results in the flagman being left behind at critical times and places, the train going on without anyone on the rear end.

It frequently happens that an engineman calls for brakes at some time when least expected and while running at high speed, and after the train has been slackened considerably, he will blow to release the brakes. As quickly as possible the flagman lets off his brake, climbs down the ladder and jumps to the ground to place torpedoes on the rail, thinking that after doing so he can get on to his train again, but he has miscalculated its speed and is left behind, remaining there to flag any following train.

Suppose that was a Fitchburg train with its usual complement of two brakemen. The conductor having had to go forward to the engine before his flagman was left, is very likely unaware that his rear is unprotected, and it requires no romancing to show in how many ways that train might easily come to grief. As, for instance, by the train parting, or approaching a siding not under control where stands an opposing train having right of track.

The torpedo is of no value in heavy storms of snow, and it is ignored almost entirely by all enginemen, excepting only when they know they are immediately preceded by a train, or else receive other danger signals in connection with it. Without this additional information they rarely shut off steam when they explode a torpedo. As a matter of fact the torpedo is antiquated, and it is remarkably strange that some far more satisfactory day danger signal has not been introduced long ere this.

The fusee is a portable time-limit block. The moment an engineman discovers its bright glare he will get control of his train as quickly as possible, because he knows that a train has preceded him within five minutes. The warning is positive, it is comprehensive, it plainly and unmistakably says *stop*, and that, too, quickly. The engineman is not the only one to see it. The conductor and brakemen, if vigilant, attending strictly to their duties, have at almost the same time the same notification of impending danger, and in many cases can bring their train under control, if not to a full stop, before reaching the fusee.

Take into consideration the opportunity given this train to protect itself against following trains. The moment the glare from the fusee is observed, the conductor or flagman ignites and throws one from the caboose; this has also been done in an instant and before the speed of the train has been reduced there has been a danger signal placed in its rear, from which it is rapidly running away, every revolution of the wheels adding to its safety. It is not necessary to wait until the train has slackened sufficiently for the flagman to get off—at the risk of personal injury and extinguishing of his lanterns. The flagman has time to be of service in setting brakes, and then to get back the distance necessary to insure protection to his train before the fusee has burned out. When recalled to his train, instead of simply placing two torpedoes on the track—and which I claim are not danger signals—he also ignites a fusee, a danger signal that will be plainly seen over any ordinary stretch of straight track behind him and that will remain there a beacon light to following trains until he has his train again under way.

Fusees are invaluable in the protection of trains that may from any cause be making poor time. When they are properly used it is only in extremely rare instances that a train has to proceed without its flagman. No engineman will pass one if he can possiby avoid it, save with great caution, for the reason that the glare is so bright that he can distinguish nothing beyond it. A fusee can be flung from any position on the train, at any rate of speed, with a certainty of not being extinguished. Should one be thrown into a snowdrift its value is only slightly impaired as a signal by the distance at which it can be seen being lessened.

How frequently does it happen that a trainman's lanterns are extinguished by the wind; by his falling over some obstacle in his anxiety to get back a safe distance; or by the oil in the cups congealing. I have many times been placed in just such a predicament, and stood in fear that some train would come along and I not be able to attract the attention of the engineman in time for him to stop. With two or three fusees in his pocket the signalman can stand until he sees a headlight, or is recalled to his train, before igniting one, and yet feel perfectly secure. The horrors of Shohola and Mud Run might have been very much less disastrous, if not entirely prevented by intelligent use of the fusee. After more than 25 years' experience on some of our most prominent railroads I have been so impressed by practical experience with the value of the fusee over all other known danger signals, that I can conceive of no argument against it save the one of expense, and that is certainly not worthy of consideration.

LANGDON.

The "Useful Effect" of Signals.

BOSTON, June 12, 1893.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Every hydraulic engineer is familiar with the term which the writer has ventured to use with reference to railroad signaling. As there is a coefficient of loss, slip, friction or other resistance, to be always taken into account in estimating the efficiency of all terrestrial movements and appliances, it is philosophical, at least, to inquire whether the same principle does not obtain in the practical workings of signal "systems," and, if so, how we can best reduce this loss of effect to the lowest possible terms.

The functions of railroad signaling are to avoid confusion, to expedite the movement of trains, and, most important of all, to prevent collisions; so that if we represent perfection by 100 and then deduct the percentage of failure to fulfil the true office of signaling, the remainder might be fairly said to represent the percentage of "useful effect" attainable.

While an immense amount of ingenuity has been expended in bringing the mechanics of signaling to such a degree of perfection as to be able to meet the complex and exacting requirements of the present most "advanced" practice, may it not be possible that we have lost sight of the problem of how to get the highest degree of "useful effect" from our signal system as a whole?

It was while riding over the Central Railroad of New Jersey the other day in company with a well known signal expert, and wondering whether the road had ever got its money's worth from the elaborate and costly system of signals there in use, that the writer made the remark (at once approved by his friend) that good signal practice really depends upon keeping constantly in mind two cardinal principles, namely, *simplicity* and *naturalness*. Perhaps these two are one; the first, however, may be considered as referring to the mechanism itself and the devices for indicating signal meanings, and the second as referring to the impression and effect of these upon the mind of the engineman who is to be governed by them. It does not follow, because a road has a great variety of signals and a complicated apparatus for working them, together with every conceivable nicety in the shading of signal meanings, that therefore the road is well signaled. If we lose sight of the two principles above mentioned, we admit an element

of danger, especially if we be an enthusiastic signal-expert, and so naturally inclined to look upon a railroad as only existing for the purpose of exhibiting our latest refinements in the art, perhaps forgetting that these signal hieroglyphics must be read (if read at all) instantly and correctly, day or night, by the engineman charged with the responsibility of taking his train to destination in a skillful and workmanlike manner and without unnecessary and perhaps dangerous loss of time.

Any system of signaling which undertakes to give the engineman any more information than simply whether his way is clear or not, say for the next block ahead, undertakes too much. Nor should his mind be overloaded with a mass of details, or special instructions and exceptions, as to the position and significance of various classes of signals, to such an extent that as much training would be required to correctly read his signals as to read a page of shorthand notes. Neither has the engineman any time on the road to solve mathematical problems, as one of their number happily puts it, *apropos* of the rows of banjo signals now adorning the Illinois Central road.

If, therefore, we wish to obtain the highest percentage of "useful effect," we must not only simplify, strengthen and standardize our apparatus, make its working as nearly perfect and unfailing as possible, add such checking devices as reason and experience approve, and then free it from inconsistencies and from puzzling uncertainties, but we must also adapt it to the mental comprehension of the average engineman, laying down for his guidance only a few fundamental principles and plain regulations, to which there should be no exceptions, and training him to overcome that insidious form of "mental inertia" which is born of over-confidence. For it may be said that, as was the case before modern signaling had been developed, it is even now true that the motive power department, *par excellence*, as well as the careful management and training of employés on the part of the operating officers, the eternal vigilance of the train dispatcher, the good condition of the road generally and the consequent ease with which trains can be kept on time, all come in for a very large share of the credit which is so freely given to the signal system however valuable and indispensable it may be—and this we all concede.

Most roads are like the happy nation whose annals are uneventful. But it is just such conditions as these that tend to strengthen the natural tendency of the human mind to fall into ruts and habits, to take things for granted, to rest in the sweet *nirvana* of placidity and repose, and to become the victim of a genial fatalism. The following incident serves in a measure to illustrate this. Soon after a bad accident had occurred on a prominent road which was supposed to have a good set of signals, the President of another first-class road who did not believe *his* enginemen could fail to regard any signal whatever, arranged a nice little scheme to test the matter; so, at a point on his road where no signal existed, he had one put in, setting it at danger, and sprung the trap on the engineer of his crack train, one of the most intelligent and reliable men, as we may presume, in his employ. But, alas for the experiment, the train whizzed by as usual, regardless of the signal and of the astonished President. Perhaps a practical operating man would scarcely have put his men in such a quandary before issuing the usual notice establishing the fixed signal as a part of the road; for such a signal suddenly appearing where none had ever been seen or authorized before, was too much like giving the poor engineman a pretty problem in operating practice and requiring him in addition to his other duties to solve it correctly and instantly.

It is to be feared that the same thing may happen even at a regular block signal under the present system of relying upon eye impressions or visual signals only, and for the very reason that the general working of a well managed, well arranged and well maintained road becomes so monotonously safe and regular, the mind of the well trained engineman, who himself is, or should be, one of the most habitually regular of beings, becomes unconsciously influenced by the constant regularity of his work, so that his confidence, or, if you please, his over-confidence, in his machine, in his road, and in his officers and fellow employés only operates to move him from his mental ruts with greater difficulty. He strongly expects all chances to be in his favor; he has always seen the signals right for him; he passes through such and such a complicated yard or junction always on time and under almost the same conditions; in fact, he is deeply confirmed in the habit of finding everything perfectly normal and safe. But there comes at last a fatal moment when dangers and difficulties begin to thicken around him; the unexpected happens when he again approaches the same point which he has passed safely a thousand times before; he fails in the most unaccountable manner to regard his distant signal, which has perhaps for the first time shown him danger instead of safety, or in the nighttime he misreads a diverging route signal, or he finds an arrangement of signals seldom or never seen before, and whose meaning he has no time to solve, and too late he realizes that he has committed a blunder worse than a crime.

It is because it is in the line of simplicity and naturalness and that it very greatly multiplies the chances against an accident, that the writer has advocated and used safeguards like the Rowell-Potter Safety stop (heretofore illustrated in the *Railroad Gazette*), believing that it is necessary not merely to catch the eye of the engineman and impress upon its retina the correct meaning of a signal; but that a mechanical aid beyond his control should promptly step in to correct any temporary failure of his own personal mechanism to work aright, and so insure that the signal is not only seen, but obeyed. For, after all, the thing that we ought to be constantly seeking is to increase the percentage of "useful effect" to the highest attainable point. But if any system of signaling itself causes an accident (as has been but too true in some instances), the useful effect in such instance, at least, is zero. A system so dangerous should either be improved or abandoned.

C. A. HAMMOND.

Valves of the Locomotives Hauling the "Exposition Flyer."

The details of the locomotives that are hauling the "Exposition Flyer" over the New York Central and the Lake Shore & Michigan Southern railroads are matters of much interest to railroad men. Illustrations of the locomotives, boilers and other details, for both roads, have been given before (See *Railroad Gazette* April 28, May 19, June 2 and 9, 1893), and we show with this drawings of the steam chest valves used on each. These are as interesting as the boilers, for after the steam is generated the most important question is its proper distribution to the cylinders, and at such speeds as are made by these locomotives the question becomes a very serious one.

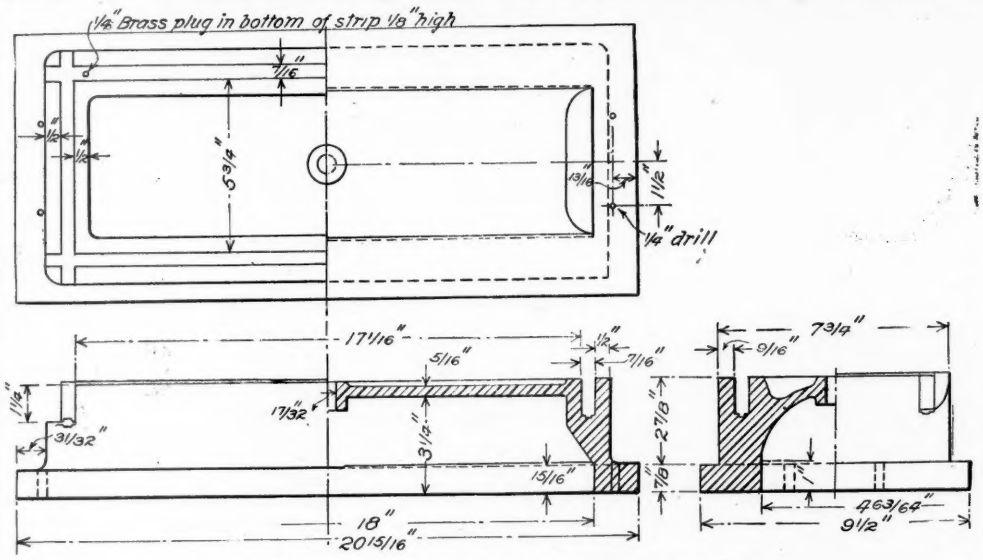


Fig. 1—Valve, Class "I" Engine—New York Central & Hudson River.

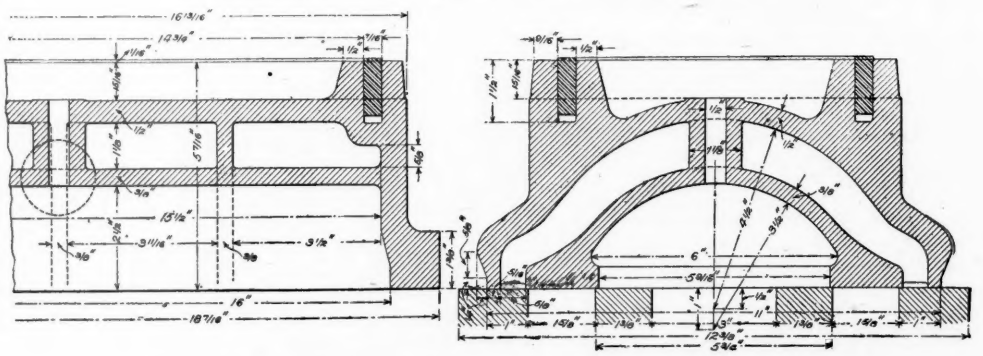


Fig. 2—Valve of Lake Shore Engine, Class "17-A"—Brooks Locomotive Works.

The two valves are interesting as being entirely different in several particulars. The valve used on the New York Central locomotive is the ordinary plain slide valve, balanced as is customary. It is shown in three views, fig. 1, and the data for it are given in the following table:

Travel of valve	5¾ in.
Lap, outside	1 in.
" inside	None
Lead	1/8 of an inch
Ports, steam	18 × 1¼ in.
" exhaust	18 × 2¾ in.
Bridges	1⅛ in.

The cylinders are 19 in. in diameter and the piston stroke is 24 in. This is all the data we have at hand for this valve.

The valve and valve motion of the Class 17-A of the Lake Shore & Michigan Southern we can give in more detail. The valve is shown in two views, fig. 2, the data for which, and the valve motion, follow:

Cylinders	17 × 24 in.
Boiler pressure	180 lbs.
Steam ports	16 × 1⅝ in.
Bridges	1⅝ in.
Exhaust port	16 × 3 in.
Allen port in valve	16 × 5/8 in.
Travel of valve in full gear	6½ in.
Valve lap, outside	1 in.
" " inside	3/32 in.
" " lead in full gear	1/4 in.

Eccentric travel ..... 5 in.
Centre of axle to centre of rocker ..... 70½ in.
Link radius ..... 68 in.
" centres of eyes ..... 13 in.
" block wearing face ..... 3 × 5 in.
" distance between faces ..... 2⅛ in.
" block flanges ..... 3½ × 7½ in.
" saddle pin ..... 1¾ × 6 in.
" " " offset ..... 5/8 in.
" hanger centres ..... 18½ in.
" lifter arms, length ..... 20½ in.

One of the peculiar features of this valve is the large area of the Allen port used. It will be noticed that with a lap of one inch this port is five-eighths of an inch wide, having an overlap on the outside of the steam port of one-sixteenth of an inch and five-sixteenths of an inch metal at the wearing face on the outside. This metal is re-inforced to nine-sixteenths of an inch thick at a distance of seven-eighths of an inch above the face so that there is no danger of breaking the valve on the outside of the Allen port. Another feature is the amount of inside lap employed, in this case three-thirty-seconds of an inch each side. This, however, is a characteristic of all the Allen valves used by the Brooks' Locomotive Works, the builders of these locomotives, and owing to the long travel employed it does not result in excessive compression at the end of the stroke as might be expected with shorter travel. One object in the use of this amount of inside lap is, that it permits the metal in the valve between the exhaust cavity and the Allen port to form a sufficient bearing upon the port face, thus preventing the hollowing out of the edges of the ports and edges of the valve, as is the case when Allen valves are constructed without having this additional bearing surface.

The principal points of difference in these valves are: The Allen port in the Class 17-A of the Lake Shore engines; the valve travel, which for the New York Central Class I engines is 5¾ in., and in the Lake Shore Class 17-A is 6⅛ in.; the inside lap, there being none to the valve of the Class I engines and three thirty-seconds of an inch to the Class 17-A; the lead, the Class I, having three thirty-fourths of an inch more lead than the Class 17-A. The ratio of the area of the steam ports to area of piston is, in the Class I, as 1 to 12.6, and in the Class 17-A as 1 to 8.73; the ratio of area of the exhaust port to area of piston is in the Class I as 1 to 5.73 and in the Class 17-A as 1 to 4.73. This means a freer admission and exit of steam through the ports of the Class 17-A engine than through those of the Class I engine. This is true for the average speeds which these locomotives make in hauling the "Exposition Flyer," but on account of the difference in the diameter of the driving wheels would not be true were the locomotives running on the same speed per hour. The average speed over the Lake Shore & Michigan Southern has been given as 46.5 miles an hour, and over the New York Central 50.6 miles an hour, an average of 3.7 and 3.3 revolutions a second, respectively, so that the steam has practically the same time to enter and leave the cylinders in

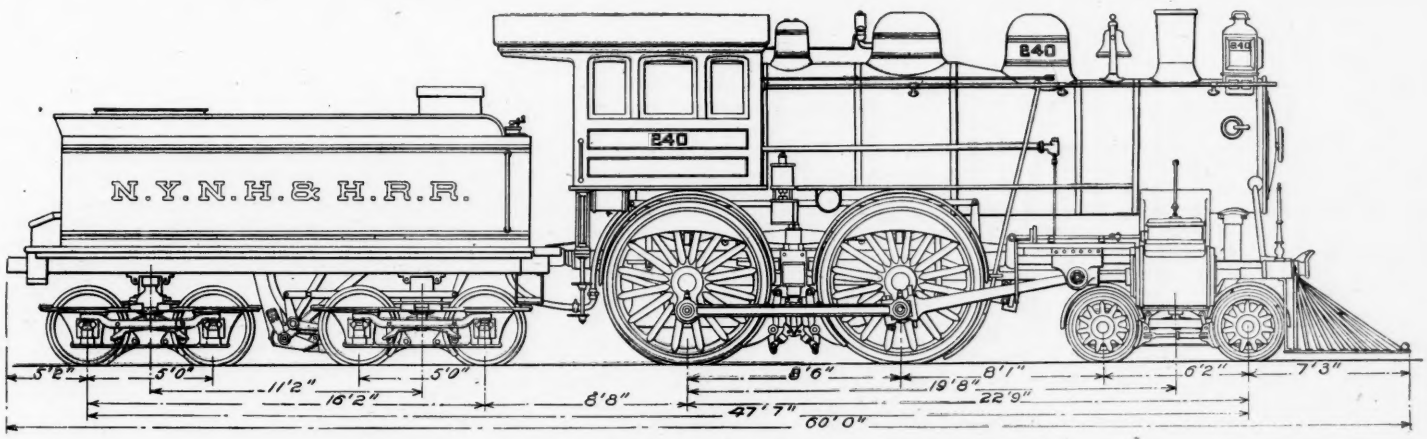
each case, but has the advantage in the Class 17-A engine of the smaller ratio of area of ports to area of piston.

It would be extremely interesting to compare indicator diagrams taken from these engines at the same number of revolutions a minute, the same cut-off, and, excepting the valve design, everything affecting the steam distribution as nearly the same as possible.

Express Locomotive, New York, New Haven & Hartford Railroad.

We show an elevation of a powerful express locomotive designed by Mr. John Henney, Jr., Superintendent of Motive Power, New York, New Haven & Hartford Railroad, and built by the Rhode Island Locomotive Works. This engine is designed for fast runs with very heavy trains, and the company has now in service 15 of these locomotives, giving excellent satisfaction. Some of the principal dimensions are given in the table below.

Size of cylinders	20 × 26 in.
Diam. driving wheels	78 in.
Driving wheel journals	8 × 12 in.
Diam. engine truck wheels	33 in.
Engine truck wheel journals	5½ × 8 in.
Driving wheel base	8 ft. 6 in.
Total wheel base of engine	22 ft. 9 in.
" " " " and tender	47 ft. 7 in.
Diam. boiler at front end	64 in.
Style of boiler	Radial stay, extended wagon top
Diam. of tubes	2 in. O.D.
No. of tubes	248
Length "	10 ft. 8½ in.
Firebox	120 in. × 41 in.
Heating surface, firebox	178.2 sq. ft.
" " tubes	1,112.7 sq. ft.
" " total	1,290.9 sq. ft.
Grate area	34.1 sq. ft.
Boiler pressure per sq. in.	180 lbs.
Distance from centre of boiler to top of rail	8 ft. 8 in.
Weight on drivers	83,500 lbs.
" " truck	41,500 lbs.
" of engine in working order	125,000 lbs.
Capacity of tank, water	4,000 gals.
" " " coal	6 tons
Diam. tender truck wheels	36 in.
Fuel	Anthracite coal



20 in. × 26 in. Express Locomotive—New York, New Haven & Hartford Railroad.

Mr. JOHN HENNEY, JR., *Superintendent of Motive Power.* *Built by the* RHODE ISLAND LOCOMOTIVE WORKS, *Providence, R. I.*

The Master Car Builders' Convention.

DISCUSSIONS AT THE FIRST SESSION.

We published last week the report of the committee on

ATTACHMENTS OF M. C. B. COUPLERS.

A report of the discussion follows:

Mr. R. P. C. SANDERSON: The committee says. "We believe that the use of double buffer blocks does not interfere with the practical operation of the M. C. B. coupler." They say further: "Your committee have also made some experiments and find no difficulty in making couplings under any circumstances in connection with curves as sharp as 38 deg." Cannot the committee say that absolutely, instead of as a matter of belief? It would set the question at rest in many people's minds. As to the the drawiugs of tail-end, I would like to ask if there has been any weakness shown in recent coupler tests caused by the slot, and if there has not, I would like to suggest that the form "B" be adopted as a standard, so as to get rid of the two tail-ends. I would like also to ask about the doubling over of the tail strap. We have had a great deal of trouble with body bolsters with the lip opening out. Is it necessary to double it on itself and weld it and pass the bolt through the double portion? Where the dead blocks are proposed to be bolted, especially in gondolas, the brake-shaft goes through the end sill; also there are two bolts for carrier irons and two bolts for the strap that hold the end sill; thus nearly all the wood is cut away. Is it necessary to bore 4 additional holes for the dowels? Would not the 2 bolt holes be sufficient?

Mr. BRONNER: The committee can say that they know that couplers can be coupled with dead blocks under all conditions on any curve that they will meet in yards. We have coupled cars that have been in use several years where the drift gear has been driven back. We have coupled them on curves as sharp as 38 deg. On such curves as that, however, we could only couple such couplers as had provisions made for coupling on sharp curves. We attempted to show that the buffer blocks did not interfere on curves of that degree, but the ordinary M. C. B. coupler would not couple there. The locks would not act unless there was some provision made for coupling on curves. The committee will say that they know that the buffer blocks will not interfere with the action of the coupler on curves.

About slots in shanks we notified the committee on tests of the action we intended to take and asked for information, but received no information, and so were unable to answer that question; but as there is comparatively a small number of roads using the slot we thought it undesirable to incorporate it in all couplers, nd have therefore shown but two designs and would Prefer the adoption of the two. We do not know of any weakness that would arise from it, but there is a possisibility of it.

We find that there are quite as many of the members who are using the yoke without any bend whatever as are using the yoke with the bend at the end—a straight piece, no bend at all. Some of the committee are of the opinion that the bend was of no practical value, but others think it might be of benefit, and we therefore have shown it, as it certainly can be no detriment to the yoke. Some of us thought that the two 1⅛-in. rivets would certainly hold the yoke to the coupler. As to the dowels on buffer blocks, I presume that Mr. Sanderson's point is well taken. But we find on examination that a great many of them in use are skewed around. We put on the four dowels as an additional safeguard, but on account of the use of two bolts I think that two dowels only might be used. Where a wooden deadblock is used to receive the iron blocks it would not make any difference, but in the cases where the iron buffer block is placed on the end sill the dowels might weaken the timber.

Mr. W. H. LEWIS: I seriously question the accuracy of the statement of the committee about their coupling the M. C. B. coupler with the deadblock on a 38-deg. curve, if they are constructed according to the standard. It frequently happens that cars with the M. C. B. drawbar, on the ordinary switches, will not couple. On a curve of 15 deg. it sometimes becomes necessary to pull out the cars on a straight track before we can make coupling.

Mr. BRONNER: Possibly the couplers would not couple. But if the couplers had been able to couple on that degree of curvature the dead blocks would not have interfered. Most couplers would not couple on that curve, but I spoke of those couplers on which a provision was made for coupling on curves, that is, that would lock before the knuckle had swung completely back.

Mr. SANDERSON: I would like to ask if the distance from the inside of the knuckle on those couplers to the face of the dead block is the same as the standard?

Mr. BRONNER: No, sir; it was less than the standard. The drawbars were old and had been driven back.

Mr. WAITT: I have tried this to my own satisfaction over and over again, and have found the only difficulty was with couplers that could not be coupled whether they had dead blocks or not on any sharp curve.

Mr. A. E. MITCHELL: We have used dead blocks on all our cars for years, and we have never experienced any trouble on the road so far as I know in coupling cars on curves.

Mr. MACKENZIE: I would like to ask a question respecting the recommendation of the committee as to the adoption of a standard draft spring 6¼ in. diameter, 8 in. long, with 22,000 lbs. capacity and 2⅛ free motion. I wonder if the committee consider that they can get enough steel in that space to make a 22,000-lb. capacity spring.

Mr. BRONNER: We submitted specifications to prominent spring manufacturers and found that we could. We have not considered a tail bolt, we have not specified any size for a hole and we possibly may not be able to get a tail bolt through, but the committee is of the opinion that the tail bolt should not be considered, as it is soon to be a thing of the past.

On motion the report of the committee was accepted and the committee was discharged, and recommendations 1, 2, 3 and 4 were ordered to be submitted to letter ballot.

TOPICAL DISCUSSION, CARS DESTROYED BY CYCLONES.

Mr. JAMES MCGEE: I would like to inquire who is responsible for a car destroyed by a cyclone, whether it is the owner of the car or the road on which the car is destroyed.

Mr. G. W. RHODES: I should certainly say the road which the car is on. The purpose of the interchange rules is to facilitate getting cars on to foreign lines. If there were no rules and cars did not get on foreign lines and a cyclone passed over the road's home, cars would be destroyed. When the foreign car is on a home line it is considered as a home car, and the line on which the cyclone occurred is responsible for that car that is damaged, I should say.

Mr. MCGEE: That is my opinion.

Mr. MACKENZIE: I have had personal experience of foreign cars being destroyed by a cyclone, and the owners were responsible for the car, under a legal decision, the destruction being regarded as an act of Providence.

Mr. SANDERSON: I would like to ask what the difference is between a cyclone and a washout. We are all responsible for a washout.

Mr. MACKENZIE: Perhaps the courts would decide against a washout, too, if they had it before them.

Mr. ADAMS: A cyclone certainly is a providential act, but for a washout a railroad might be entirely responsible, in not having made culverts with sufficient waterway. The Almighty might sweep the earth with a cyclone and we could make no provision for it.

Mr. LEWIS: Mr. Rhodes puts the matter quite plainly—that if it were the car of the company on whose road the cyclone occurred, it would certainly be that company's loss. I do not see how we can make any distinction between damage by cyclone and damage by lightning or by washouts. The car is in possession of the home company, and for any damage that results to it while in their possession I think they are responsible and not the owner.

The PRESIDENT (Mr. Guire): Rule 2 seems to cover the question: "Cars must be delivered in good running and returned in as good general condition as when received." A road having a foreign car cannot deliver it in good general condition if it is destroyed by a cyclone. They must return it or pay for it.

REPORT OF COMMITTEE ON METAL FOR BRAKESHOES.

Mr. RHODES: The report says: "The composite shoes consisted of cast iron with a small percentage of wrought iron in the rubbing surfaces extending through the shoes, the percentage of wrought iron being somewhat less than 7 per cent. of the whole surface." On our line we use a composite shoe and have done so for a number of years on account of the saving we find. But it is not a shoe of this character. It has in the neighborhood of 40 per cent. of wrought iron. I can readily see that where it is made with only 7 per cent. it might give entirely different results.

Mr. J. W. MARDEN: We have made quite a number of experiments as to different metals for brakeshoes and we find that on steel tired wheels we cannot run with as good results with the same kind of metal as we can on chilled wheels. In fact, we are using to-day nothing but chilled brakeshoes on steel tired wheels. On cast iron wheels we are using a composite shoe and we are also using what is known as the Congdon shoe.

Mr. LEWIS: We get good results from the use of all the different varieties of brakeshoes mentioned, and there is not any of them that has developed any serious weakness, and when you refer to the tests on page 17 of this report you will notice that the consumption of cast iron shoes is stated to be 23,530 lbs., while the consumption of steel shoes is from 1,680 to 2,337 lbs. In other words nearly 20 times as much cast iron is used in the same service as steel. Now the difference in the cost between steel, composite and cast iron is not above a ratio of 2 or 3, while the wear is as 1 to 20. I have never considered that a steel shoe was objectionable for a driving brakeshoe, and I never have known them to injure the tires, and if they wear 20 times as long as a composite or cast iron shoe I think it would pay us to use them.

Mr. WAITT: The length of time that the shoes of various materials will wear is offset considerably by the

amount of shoe resistance or holding power. I notice by the tables given in the report that there is a material difference in the resistance between cast iron and steel. It seems to me that that ought to be taken into consideration, and that we ought not to base a decision as to what is the best metal for brakeshoes entirely upon the wear. Then, of course, will come the consideration of the effect on the wheels. I am not prepared to say that nothing is gained by changing metal for brake shoes, but it has been said that just so sure as you get a brakeshoe that wears longer you are near the tire more and in the same proportion or nearly so as the gain in the wear of shoe.

Mr. SANDERSON: We made some trials about four years ago with some heavy shifting engines, putting cast iron shoes on one side of the engine and steel shoes on the other. We found that the steel shoes were 6½ more durable than cast iron shoes. We have been using cast steel shoes since then on the driving wheels on all our larger engines and on heavy mountain engines, and find that the steel shoes cut down the tires about as fast as the wear of tread by the rail. I found an engine that had been on the road two years on heavy mountain service and did not require re-turning of tires. The shoes were of the Ross type, and of steel. In the tests given in the report I would like to ask whether there were any release springs on the brakebeams. The power seems to be calculated from the pressure in the cylinder. We made some rough tests with a hand dynamometer and found it took over 800 lbs. with some forms of release springs to pull the shoe up to the wheel.

The SECRETARY (Mr. Cloud): As the report states, the information was furnished by the Pennsylvania Railroad Company. The report did not give any information about how the pressure was measured. The road uses a release spring and I presume it was used in this case, but how much it took to overcome it I have no idea.

Mr. LEWIS: We know that the Ross-Meehan shoe is designed to wear the part of the wheel that is not in contact with the rail nearly as fast as the wheel itself wears, but have never seen a shoe constructed in that way that has worn the wheel as fast as the wheel will wear on the rail.

Mr. HAYWARD: It is as much a question of economy as of efficiency. What we want is to get an efficient brake that will stop our trains in the shortest space. I think the aim of the Association should be to get the most efficient brakeshoe friction, regardless of cost, as long as it was not too excessive.

Mr. CLOUD: These tests are not offered as conclusions, or as of sufficient importance to warrant any deductions, but simply as so much information which is a mere handful compared with what we ought to have. In dealing with the amount of metal used I dealt with one side of the question only, and entirely left out of consideration the other and very much more important side of the question which Mr. Hayward has referred to, namely, the efficiency of the brake.

I want to call your attention to the fact that you have had a committee for three or four years to investigate this subject. It is one which needs to be elucidated by tests which cannot be made without some expense. It seemed as though the expense would be more than any one or two roads would care to go into. The Association now has a surplus of something between five and six thousand dollars and I do not know at the present time what would be likely to yield better results by expending the money than to devote it to a series of tests on this subject under the direction of a committee to be appointed by this Association.

Mr. HARRISON: We have been conducting experiments on the Baltimore & Ohio road for some time to find out the most economical brakeshoe for our service. We have had experience with the wooden, the wrought iron and the cast iron shoe, and when we look into the matter we find that we want to take the wear of the wheel into consideration, and the conditions are so entirely different that it is almost impossible to get at any result at all. We are changing our cars, running them first to one place and then another, until we find that the only thing we could do is to take a local train. We are making brakeshoes in our foundry, of different grade, one of 50 per cent. scrap and 50 per cent. new metal, and of different kinds of metal, and we are trying them all. We are having all shoes tested from different foundries to see what the value of the shoe is, and are using them on our local trains, but we have not arrived at any conclusion yet as to what the best metal would be. Soft metal has given very good results.

Mr. ADAMS: Steel wheels are pretty expensive and if you are going to wear steel tires faster in using a certain kind of shoe than another, you will lose more money in your wheel than you save in your brakeshoe; this has a very important bearing on the matter.

On motion of Mr. Mackenzie, a committee was appointed by the chair to report at the last session on the advisability of making brakeshoe tests. On Friday this committee reported as follows:

The importance of a complete and thorough test of brakeshoes will become manifest to anyone who peruses the data on the consumption of shoes presented by the secretary in his very valuable report. This committee is well satisfied that not only are the tests perfectly feasible but that with a little co-operation on the part of the railroads both road test investigations and shop, or laboratory, investigations in complete detail can be presented to the next annual convention at but very little cost to the Association. To carry this out the committee would propose:

First—To conduct the road tests: the appointment by the executive committee of a committee of not less than 12 members from an equal number of railroads in different sections of the country, who shall have signified their willingness to participate in the tests. It is deemed important that a large committee should be named in order to have a representative of the committee to superintend the road tests while in progress on that line.

A committee of three from the general committee of 12 to be named who shall frame out the work of the committee, viz: provide brakeshoes, scheme out a line of tests to be followed and sum up the results. It is obvious that to get any results from these road tests, the work must be taken in hand at once.

Second—To conduct the shop or laboratory tests: The appointment of a separate and distinct committee of three from either association, active or representative membership. It is believed that arrangements could be made with the Purdue University for all friction tests with shoes of different metals against steel-tired wheels, and possibly also against cast iron wheels. If the latter is not practicable at the university, arrangements without doubt could be made in connection with some of the mechanical exhibits at the World's Fair. It is thought by the committee that these tests can be carried out with very little expense to the Association, but in order to provide for any emergency which may arise, it is recommended that the executive committee be authorized to expend on account of these tests a sum not exceeding $500.

Committee, { P. E. MARSHALL, G. W. RHODES, R. P. C. SANDERSON.

Mr. RHODES: I move that the report be referred to the Executive Committee, with authority to spend $500 if necessary. The motion was carried.

Willingness to make road tests for the Association was announced on behalf of their respective companies by representatives in the convention of the following roads: The C. & O., the C., B. & Q., the C., B. & M., the Fitchburg, the Norfolk & Western, the P. C. & St. L., the N. Y., L. E. & W., the Pennsylvania, the Northern Pacific and the Central R. R. of New Jersey.

SECOND SESSION.

The Secretary announced a delegate to the M. C. B. Convention from the Supreme Lodge Car Inspectors' Protective Association of North America and read his credentials, and a letter asking permission to address the Convention and to explain the views and objects of his Association. This permission was denied; but the President, on behalf of the M. C. B. Association, invited the delegate to remain and attend the meetings.

At the request of the President, the Vice-President, Mr. Lentz, took the chair, and the Rules of Interchange were taken up, a motion being made and carried that the rules be read one by one and action be taken upon each. Rules 1, 2, 3, a, to 3, o, were not changed. Rule 3, p, was changed on the recommendation of the Central Railway Club so that the axles of cars of 50,000 lbs. capacity may have 4¾-in. wheel seat and cars of 40,000 lbs. capacity may have 4⅝-in. wheel seat. Rule 3, t, the Committee recommended the insertion of the word "*hand-holes*" after ladders, so that the rule should read "steps, ladders, hand-holes or running boards in bad order or insecuredly fixed;" adopted.

Considerable discussion was raised as to the distance of brake attachments above top of rail. Many members were of the opinion that if the rule was enforced requiring every part of the brake attachment to be 2½ in. above the rail, one-half of the cars of the country might be refused by other roads. It ended in a vote by acclamation resulting in the rule being adopted as it now stands, viz., 2½ in. in height. A standing vote was called for which resulted in a vote of 6 to 48 in favor of the rule as it exists.

The rules as to M. C. B. couplers damaged and broken were not changed.

On the suggestion of the Central Railway Club a "partial repair card" was proposed by the Arbitration Committee to cover partial repairs necessary to put the car in safe condition for running, but the Committee did not concur in recommending it and the Convention voted to keep the rule as it is. An attempt was made to introduce something to take the place of a partial repair card by inserting in Rule 6 a provision for those cases when partial repair cards were made. This provision required the erasing from the defect card of what had been put on it and making a copy of the card in its exact phraseology to be attached to the bill for the partial repairs. The objections of the members of the Convention to this scheme were principally that it detailed a good deal of clerical work. The rule was left as it is. Considerable effort was made to pass this on the part of trunk lines who claim that these partial repairs, though of small expense usually, are imposed upon them, the idea being that cars from smaller roads in going over trunk lines become slightly injured and require slight repairs; therefore, there was a standing vote taken, which resulted in the defeat of the change by a vote of 33 to 42. One of the Eastern lines called for a vote by representation of cars. This provoked considerable discussion as to whether any but representative members could vote when a *vote by cars* was called. The sense of the Convention apparently was that all active members of the Association were entitled to one vote and to an additional vote for every thousand cars represented. A vote, as reported by the Secretary, was 405 in favor of the change, to 297 opposed to it. A two-thirds vote being necessary to adoption, the motion was declared lost.

The Central Railway Club having proposed the insertion of a new rule to cover what the club calls "*Home defects*," the Convention next took it up. The rule is intended to cover minor defects on homeward bound cars and if adopted would allow a company to pass a car along without putting upon it a defect card. Some of the defects enumerated in this rule would have required changes in some of the other rules adopted by the Association. Motion was made which brought it before the Convention, but the recommendation of the Arbitration Committee that the rule be not abopted. was carried.

The Committee having recommended a change in the price for wheels, the Convention adopted it *in toto*. As changed it now stands as follows:

	New.	Second-hand.	Scrap.
36-in. wheel	$10.00	$7.00	$4.50
33-in. "	8.50	6.00	4.00
30-in. "	7.00	5.00	3.50

The Committee made no recommendation as to the price of axles, but on motion the 40,000-lb. axle was changed to read "one axle 40,000 lbs. *or under*" *new*, $9.00, second-hand $5.50 instead of $6.00. Scrap $3.50.

Rule 16 was changed by the addition of the following: "Any company finding a link and pin drawbar in a car originally equipped with a drawbar of the M. C. B. type and so marked and carded for wrong material, may replace the link and pin drawbar with an M. C. B. drawbar and bill upon the card to the railroad company carding the car for the wrong drawbar.

Rule 18 was slightly changed by the insertion of a clause at the end, so that the last sentence now reads: "The splicing of two adjacent sills at the same end of the car *or above crosstie timbers* will not be allowed."

In Rule 19 the Convention followed the recommendation of the Committee by striking out the last sentence of the rule with regard to the removal of a foreign drawbar. It was further changed by the addition of a clause pertaining to the link and pin couplers in the following words: "*Cars originally equipped with link and pin couplers shall be accepted provided the drawbars have sufficient strength and are in good condition, requiring cards only for alteration of attachments.*" This addition was proposed at first for Rule 16 and provoked a good deal of discussion as to the M. C. B. coupler. The sentiment of a considerable number of the Association is evidently that the present form of M. C. B. coupler will be permanently used by railroads. There seem to be yet many adherents of the link and pin coupler and there were expressions from members that there must be a new form of coupler not yet brought before the public, embodying perhaps the good features of the M. C. B. coupler and avoiding some of the bad features.

Rule 20 was modified by the insertion in the middle of the rule after the words "a defect card," the words "except as provided for in Rules 16 and 19."

Rules 21 and 22 were not changed and Rule 23 was changed on the recommendation of the Committee making the additional settlement price $40 00 for each car equipped with air brakes instead of $50 00, and crossing out the word "piping" as being something that could be returned to a road when its car had been destroyed. Some modifications were made in the prices for car bodies. The prices for feeding and watering attachments to stock cars were crossed out and stock cars placed in the same clause and class as refrigerator cars and other freight cars designed for special purposes.

Rule 24, with regard to the delivery of cars to the next point of the road owning the car brought up some interesting cases. Some roads, under the same general management, but keeping their accounts separate, require that a car shall be delivered to that portion of the road whose accounts were kept separate, whether the line was owned and operated or not. To avoid these cases of dispute the rule was made to read "and delivered free of freight and other charges to the nearest point on the line of the company owning and operating the car."

Rule 25 was left unchanged, and certain changes were recommended in the prices for material furnished on defect cards under Rule 26. The table as changed now stands as follows:

Material.	Charge.	Credit.
Cast iron, per lb	$ .01	⅝ cent.
Malleable iron, per lb	.03½	½ "
Bolts, nuts and forgings, per lb	.04	1 "
Steel castings, per lb	.06	¾ "
Spring steel (not springs), per lb	.05	¾ "
Brass-bronze journal bearings, per lb	.13	9 cents.
Lumber: Yellow, white and Norway pine, poplar, oak, hickory and elm, per ft	.03	.....
Labor, per hour	.20	.....
One box or stock car side door, applied	5.00	.....
One box car ventilated side door, wooden frame with iron rods	8.00	.....
One box or stock car framed end door	3.00	.....
Chain, per lb	.05	1 cent.
One air-brake hose and coupling, applied	2.20	.....
One M. C. B. coupler, with pocket attachments	....	.....
One M. C. B. coupler, with tail attachments	....	.....

It was voted that the executive committee determine and insert in this table the prices of M. C. B. drawbars of two patterns, one for pocket attachment and one for tail-bolt attachment and the sentence in regard to the charges at manufacturer's prices was changed so as to read "that the couplers may be charged at the price '*fixed in the rules*' plus the customs duty which must be paid on entering Canada."

The prices for labor for replacing sills, etc., were referred to a special meeting to report during this Convention, and also to act upon the recommendations of the Arbitration Committee as to the insertion of some new items recommended.

Rule 30 was cut out, and the following inserted:

"In order to settle disputes arising under the rules, and to facilitate the revision of the rules at the annual conventions of the Association, an arbitration committee of five representative members shall be appointed annually by the executive committee; three members of this committee to constitute a quorum. The committee shall ask for suggestions of changes, amendments and addi-

tions to these rules prior to each annual convention, which it shall consider, and it shall report its recommendations to the succeeding annual convention."

Rule 21 suffered the same destruction and the following was inserted on the recommendation of the Central Railway Club.

"In the revision of these rules by the Association each railroad company shall be entitled to one vote for each full one thousand 8-wheel cars owned or in use or in process of purchase in addition to the personal vote of its representative member. Two four-wheel cars shall count as one eight-wheel car. A two-thirds vote shall be necessary for adoption.

The entire forenoon was given to the discussion and adoption of these Rules of Interchange and the Convention adjourned until Thursday at 9 o'clock.

SESSION OF THURSDAY, JUNE 15.

Discussion of Report on Axles, Journal Boxes, Lids and Wedges.—This report was published in our last issue. Engravings of the parts recommended for the 4¼ in. × 8 in. journal are shown herewith; those for the 3¾ in. × 7 in. differ only in dimensions.

Mr. R. H. SOULE: I might say in addition to what is stated in the report that the Committee on Standard last year recommended that the standards should be illustrated by a series of full size drawings. In comparing this report on journal boxes it was necessary to assume some size of drawing, and the size of sheets herewith was selected.

Mr. WAITT: I move that the recommendations made by the Committee on Standards, except so far as the details may be modified by action taken on the reports of the special committees, be adopted by the Association and submitted to letter ballot. Seconded by Mr. Marshall and carried.

Mr. MARSHALL: I move that the recommendation of Mr. Soule's committee of this year on axle journal boxes be submitted to letter ballot. Seconded by Mr. Waitt and carried.

DISCUSSION ON DRAWBARS AND BRAKEBEAMS.

[Report printed last week.—EDITOR.]

Mr. WAITT: In order to get this matter before the Association I would move that it is the sentiment of this Association that their understanding of the decision of the American Railway Association is that 34½ is the maximum height and 31½ intended to be the minimum height of drawbars, when measured from top of rails to centre of drawbar when the cars are empty.

Mr. RHODES: That is hardly the intention of the American Railway Association. The idea was 34½ in. maximum and 31½ in minimum, or, as they stated it, 34½ in., with a 3 in. variation. Now the maximum must be empty, and the minimum must be loaded.

Mr. SOULE: We must have a standard height of drawbar, and the variations from that height are another thing, because for our shop practice we are governed only by standard height. In designing, constructing and repairing cars we want to know what is the standard height. I think there are two reasons why we ought to express our sentiments as in favor of that 34½ as the standard height. One is because the action of the American Railway Association can be considered as indicating that that is their preference, also because the report of our committee leans that way. Mr. Rhodes said it was impossible to ascertain the sentiment of this Association until we actually get a letter ballot. I do not quite agree with that, because this report is a very definite forecast of what the result of a letter-ballot would be; it shows the representatives of 79 per cent. of the cars controlled by roads in this country say that they can raise the height of those cars to 35 in., and to make 34½ in. the standard would be directly in line with the findings of this committee. I do not think it would be right to make the variations the same above and below the standards. We should allow a little variation above that and a great deal more variation below it, owing to the conditions with which you are all familiar. Therefore, I offer as an amendment to Mr. Waitt's motion that it is the sentiment of this Association that 34½ in. should be the standard height of drawbar and that the maximum and minimum variation should be 35⅛ in. and 32½. That allows 1 in. variation above the maximum and 2 in. below it.

MR. CLOUD: The motion now before you is that this Association understands that 34½ is intended by the Railway Association to be the maximum height, or height when the car is new and empty, measured from the top of the rail to the centre of the drawbar, and that 31½ is intended to be the minimum height which can be run in conformity with the law under any circumstances. Carried.

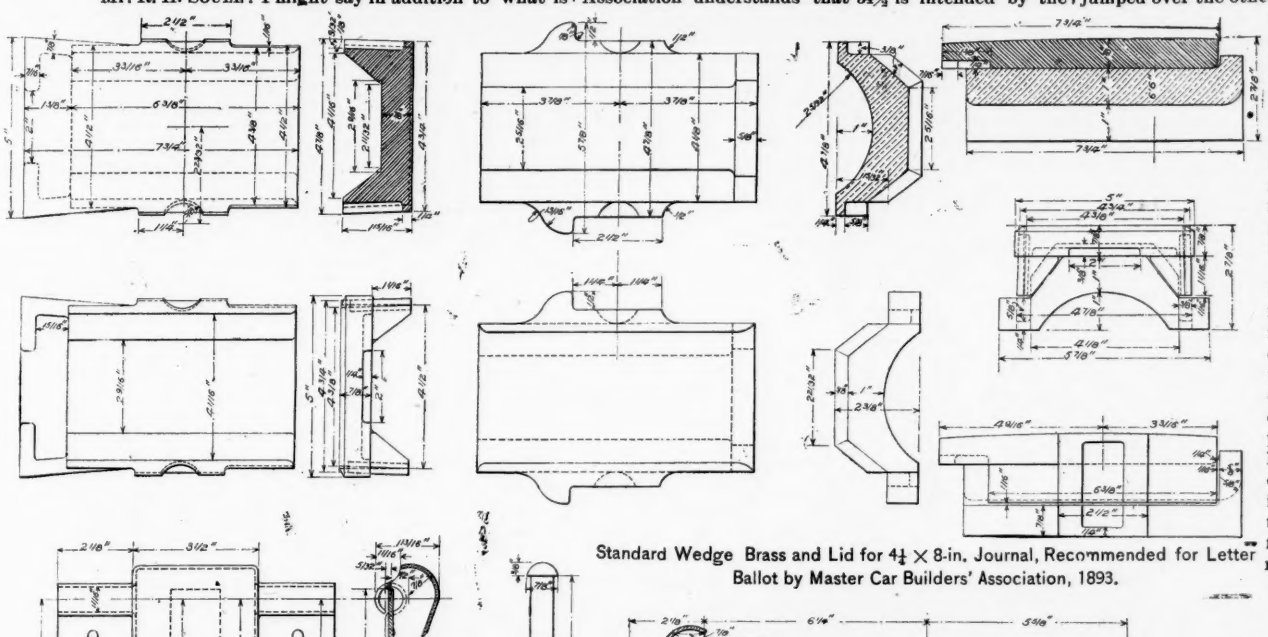
The Secretary was authorized to communicate this motion to the Secretary of the American Railway Association, and also to the Secretary of the Interstate Commerce Commission by wire. A reply came on Friday as follows:

"The Railway Safety Appliance Act authorizes the American Railway Association to fix the standard height of drawbars for cars in use, and the Association fixed height at 34½ in., assuming that the standard height for shop drawings would be fixed with due allowance for settling to 34½ in. after a car was put in use. H. S. HAINES."

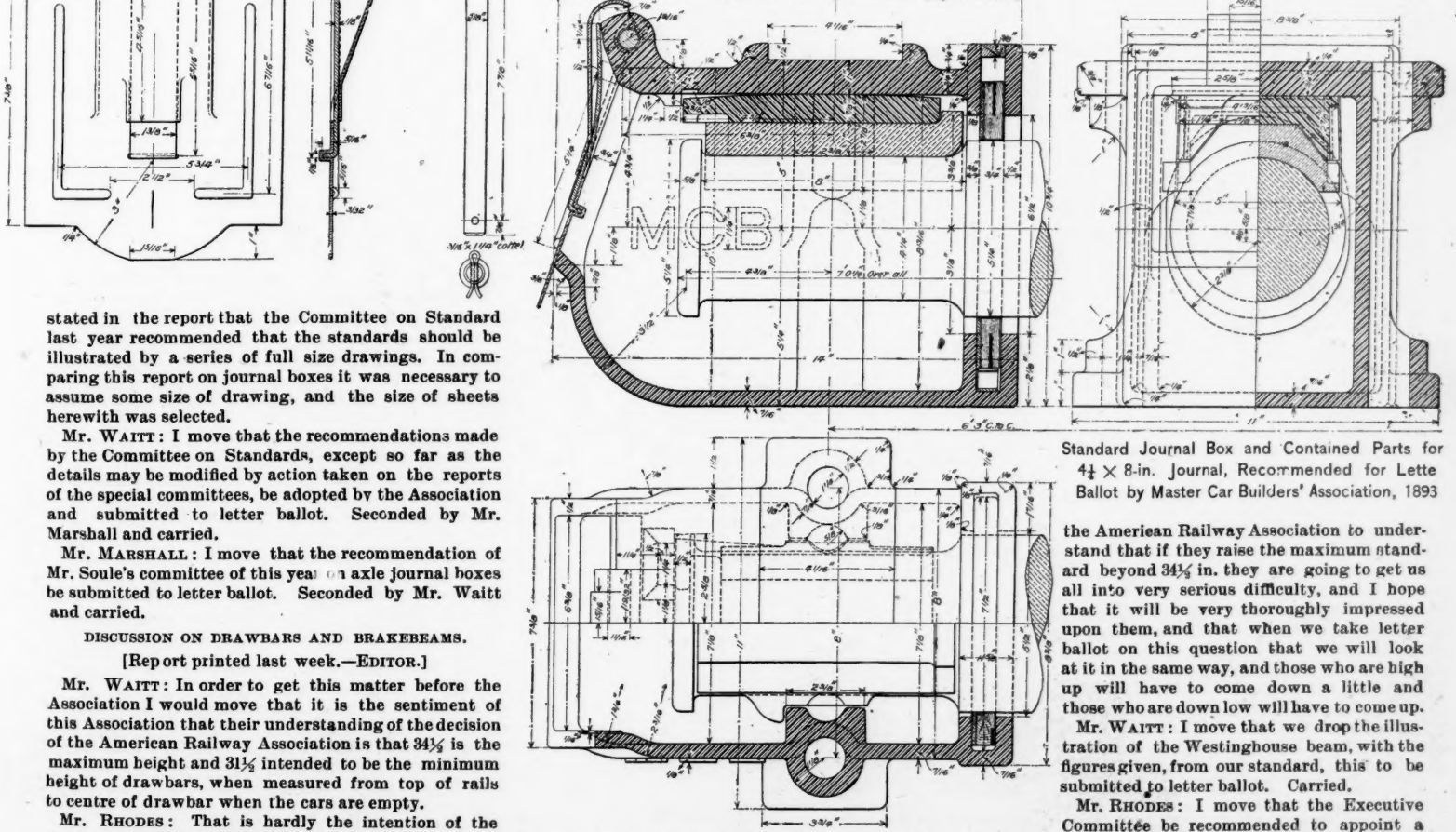
Mr. WAITT: I now offer the original motion that was seconded by Mr. Rhodes that the heights that are promulgated by the Interstate Commerce Commission be submitted to letter ballot so that our standards on our books may be made to conform with the standards we have to work with. Carried.

MR. RHODES: It is true we can use considerable variations of heights without any slack between the coupling, while the cars are moving smoothly, but when they begin to dance up and down it becomes quite a serious question as to the safe difference in the heights of cars. I found in order to grip successfully the two lugs of the knuckles with not less than 1 in. grip on one knuckle that we could not admit of a variation of more than 2½ in. between the cars. If we disregard the importance of having the two lugs grip together we can have a 4½ in. variation. On some lines in the West we have found that with cars coupled with a vertical plane coupler, that varied a good deal in height, one coupler jumped over the other. We found that where a train repeatedly parted there was a variation between heights of 5 in. between the cars both connected with vertical plane couplers and that proved to be quite unsafe. I think that if the members of the Convention would get an actual average of all the cars that are running they would find that the number that are below 30 in. is much more than they have any idea of.

It is not always well to consider the averages given in reports as representing the condition of cars in service. Members of this Association do not answer circulars in the way they ought, and therefore deductions from the answers received are apt to be wrong. In point of fact the committees who have made the report that 79 per cent. of the cars can be made 38 in., control 50 per cent. of the cars they report on. So that it is not fair to assume that the report represents the average condition of cars. I say this because I want the American Railway Association to understand that if they raise the maximum standard beyond 34½ in. they are going to get us all into very serious difficulty, and I hope that it will be very thoroughly impressed upon them, and that when we take letter ballot on this question that we will look at it in the same way, and those who are high up will have to come down a little and those who are down low will have to come up.



Standard Wedge Brass and Lid for 4¼ × 8-in. Journal, Recommended for Letter Ballot by Master Car Builders' Association, 1893.



Standard Journal Box and Contained Parts for 4¼ × 8-in. Journal, Recommended for Lette Ballot by Master Car Builders' Association, 1893

Mr. WAITT: I move that we drop the illustration of the Westinghouse beam, with the figures given, from our standard, this to be submitted to letter ballot. Carried.

Mr. RHODES: I move that the Executive Committee be recommended to appoint a committee to report on the paragraph of the committee's report relative to the standard height and location for centre of beam for outside hung brake. Carried.

DISCUSSION ON PROTECTION OF TRAINMEN AND LETTERING FAST FREIGHT LINE CARS.

[This report was printed last week.—EDITOR.]

Mr. SOULE: I move that this present Committee on the Protection of Trainmen and Lettering Fast Freight Line Cars be continued with instructions to report next year, and then modify their findings in accordance with the action of the Convention in this matter of the report of the Committee on Standards. Seconded.

Mr. LEEDS: The law calls upon us to put on irons.

Now as to gondolas, I have found it is just about the same as putting it on the end of a car that has the end sill outside the siding. I was going to recommend that there be a distinction made between the height of a car that had the end sill outside the side and that of a car that had the side outside the end sill.

The PRESIDENT: I do not think it is the intention to place handholds on the ends of gondolas, but you could put them on the ends above the end sill.

Mr. LEEDS: I would like to have that height established.

Mr. BLACKALL: I would like to ask, What is the object of putting the handhold on the end of the sill? It seems to me that it is about as dangerous a device as could be attached to a car.

The PRESIDENT: The purpose of putting the handhold there was to meet the requirements of the coupler bill. Our standards did not have any handholds except for stock and box cars.

Mr. HENNESSY: Would not the uncoupling device on the M. C. B. coupler answer for one of the handles which runs clear across the end of the car on one side?

Mr. LEEDS: I object to this going over to another year. I have studied how to get a handhold on the end of a flat car without endangering the lives of the men in coupling. It is plain that with an automatic coupler they will not need one. The only way is to chamfer the ends of the plank so as to give room for the hand and have the handle on a line with the edge of the plank. I do not see any other device that is not dangerous to trainmen. With broken drawbars and deadwoods coming together, there is no room for men in there without being cut in two by the various safety appliances we are putting on.

Mr. MCKENZIE: I think the suggestion offered by Mr. Leeds is a very good one. A grab iron on the end of a flat car is just as necessary as on a box car. The location of the grab iron on gondolas should be the same as on the end of a box car. This would not be necessary where you have drop-end gondolas.

At this point a committee was appointed to confer with the Committee on Standards and report on Friday. On Friday the committee reported as follows:

1st. That both subjects be included under the head of "Recommended Practice" in conformity with the suggestions of the committee of 1892 on Standards of the Association.

2d. That the material under the head of "Protection of Trainmen from Accident" be modified as follows (with reference to present standards):

Omit the last paragraph on page 282 of report of 1892, which reads:

"That the small platform placed at one end of freight cars to fasten the brake pawl to, etc., be discontinued, the ratchet wheel and pawl to be fastened to a suitable casting on the roof."

The first portion of this paragraph seems to be of a negative character as recommended practice, and the balance of the paragraph is superfluous because it is treated in the paragraph preceding it, which we do not propose to alter.

Under Running Boards we recommend the following words:

"The ends of the running boards of box cars to be made to project over ends of cars and properly supported so that the minimum distance between the ends of those on adjoining cars will not be less than 12 ins., and that the running boards be made not less than 2 ft. wide."

Under "Steps" we suggest to have the first paragraph as it now is, and to place the second paragraph under "Ladder and Handholds" with five alterations (see below) under "Ladders and Handholds." We suggest the whole matter be altered to read as follows:

"Each box and stock car should have two iron or wooden ladders, with not less than five steps to each ladder; the steps to be not less than 3½ in. from side or end of car; each ladder to have a handhold on the roof directly over top of ladder. When iron ladders are used and placed on ends of car, the bottom step to have a guard or projection to prevent men from slipping when swinging around the end of car to get on the step.

"When the ladder is placed on the ends of car a handhold should be placed on opposite side of the end of the car from the ladder; but when ladder is on sides of car, two such handholds should be placed on each end of the car above the bottom of the sill.

"On all freight cars which are not equipped with ladders such as flat cars), two handholds should be attached to each end sill; handholds on end sills should have at least 2 in. clearance behind them, and all other handholds should have at least 2½ in. clearance behind them."

All handholds should be made of iron, not less than 5-8 diameter; and handholds on sides and ends of cars should be at least 2 ft. long in the clear. Those on end sills to be made shorter only when it is impossible to use this length.

3d.—Under the head of "Lettering and Numbering Fast Freight Line Cars" this committee concurs with the report submitted to it, viz., that paragraph No. 2, reading "doors should have no marks whatever," be stricken out and in its stead the following inserted: "Side doors to bear the initials of the road to which the car belongs, or the name of the line in which the car is used, together with the number of the car."

T. SUTHERLAND,
P. LEEDS,
S. IRVIN,
R. H. SOULE.

The recommendations of the committee were ordered submitted to letter ballot, with the amendment that when the uncoupling shafts can be utilized they be so used, the handholds then being omitted.

REPORT OF COMMITTEE ON TESTS OF M. C. B. COUPLER.

The different manufacturers of couplers of the M. C. B. type were then invited to submit four couplers to the drop tests and eight couplers to the pulling tests. A large number have responded to the request of the committee, and sent the required number, the drop tests being made at Altoona and the pulling tests on the Emory machine at Watertown Arsenal.

The details of the tests were turned over to a subcommittee composed of Messrs. D. M. Perine and G. C. Bishop, of the Pennsylvania R. R. motive power department, who have submitted the following:

We submit herewith a report of the couplers we have tested, and accompanying it all the data in detail taken during the drop tests at Altoona and the pulling tests at Watertown. You will find outlined sketches showing every fracture and photographs of all fractures, also blueprints of summaries of all the important information arranged for easy reference, showing the average of all the couplers represented, and a blueprint of the drop test machine which may be described as follows:

The machine was built on a foundation of stone of 5 × 5 ft. on top and 8 × 8 in. at the bottom, and 5 ft. deep. Upon this was bolted, by means of 6 anchor bolts, the bedplate of the machine. This was made of 4 round plates of boiler steel ½ in. thick and 42 in. in diameter, riveted together with countersunk rivets.

Two 85-lb. steel rails were used for guides for the weight and were fastened to the bedplate by means of four angle pieces, two against the bottom of the rail being bolted to the bedplate with 4-in. studs, and to the rail with four ¾-in. bolts. The other two angle pieces were placed against the face of the rail, and were bolted to the bedplate and rail by two ¾-in. studs each. The rails were held together at the bottom by means of two plates 9 × 2 ins., with four 1-in. bolts through the web of the rail, and suitable blocks to hold them 6¾ in. apart; two keys were arranged in these pieces to hold the coupler in position under the weight. The rails were bolted together by two similar pieces 9 × 1¼ in. at the top, and the whole was guyed by four guy rods. The weight was cast in two pieces and bolted together by nine 1¼-in. bolts. A hammer of forged steel with a face 4 × 10in. was bolted to this by four 1¼-in. bolts, the weight complete was 1,640 lbs. This weight was lifted by an 8-in. air cylinder 8 ft. 6 in. long, and a ½-in. steel wire rope run over the sheaves, suitably arranged to double the lift.

An ordinary tripping hook was used to trip the weight, and the tripping irons were arranged one on each side of the machine, at a height to trip the weight at 10 and 15 ft. respectively. By this arrangement it was only necessary to turn the arm of the hook toward the front of the machine to have it trip at 10 ft., and toward the back of the machine to trip at 15 ft. The coupler was placed in the machine between the two 2 × 9 in. pieces, the shank resting on the bedplate and keyed tight by means of the two keys and suitable liners. The shank was then held in place by means of blocks and wooden wedges. The weight was arranged to drop so that the edge of the nose was in line with the inside edge of the pivot pin. Before testing, the coupler was weighed complete; the knuckle removed and weighed, and the parts counted. The contours were then tried by the Pratt & Whitney gauge, and the length of the shank and guardarm measured, and the construction of the guardarm noted. This guardarm measurement is the variation from guardarm length on the Pratt & Whitney gauge. The weight was allowed to rest on the knuckle, while the original and all other knuckle openings were taken. The weight was dropped on the coupler held in position, as described, three times from a height of 10 ft., and from 15 ft. until the coupler was broken. After each of the first six blows the knuckle opening was measured, and the condition of the knuckle lock pin and shank noted. The coupler was also adjusted after each one of these blows, so that the blows were received as described. After the sixth blow the coupler was not readjusted, but the blow was taken wherever the bending of the shank permitted it. In this way many guardarm tests were made, the shank often bending so as to permit the weight to strike between the knuckle and guardarm. When the coupler was broken, the location of fracture was noted on the outline sketches, and the fracture and material described. The coupler was then photographed, care being taken to show all fractures. In the specifications adopted by your committee, it will be remembered that mention was made of the weight striking a piece of steel so arranged as to distribute the force of the blows. This was tried and abandoned, as it was found after the first blow when the knuckle became bent the full force of the blow could not be delivered, as the steel when struck by the weight would glance off the knuckle. This was only used for two blows on two different couplers, and did not in any way affect the test.

The pulling tests were conducted at the United States Arsenal, Watertown, Mass., on the celebrated Emory test machine, having a capacity of 800,000 lbs., tensile load. As this machine is so well known a description will be needless, and we will therefore only state that by reason of its construction it is particularly well adapted to this kind of testing—the machine being horizontal, the jaws being large, and operated hydraulically, giving a great range of adjustment not found in the ordinary test machine with wedged jaws. Eight couplers were required from each coupler company, and they were numbered from 1 to 8 respectively. Before the test each coupler was gauged and weighed complete, and all the knuckles were removed and weighed separately. The number of parts entering into the construction of the couplers were recorded, each washer, pin and key counting as a separate part. The bars were then divided into pairs, steel tailbolts inserted; and coupled together on the floor. Nos. 1 and 2 being coupled together, 3 and 3, etc. A rope sling was then placed around the couplers, and by means of an overhead traveling crane, already provided in the testroom, the couplers were lifted into the machine, and the steel tailbolts gripped securely. In the case of couplers having yokeblocks cast on the ends of the shanks, blocks were gripped in the jaws of the machine so as to catch the yokeblocks. This was the only deviation from the use of tailbolts during the test. After adjustment a load of two or three thousand pounds was brought to bear on the couplers, in order that they would support their own weight and also take up all lost motion in the parts. The original openings of the knuckles were then measured. These and all other knuckle measurements were made with a steel scale in a line drawn through the linkpin hole parallel to the centre line of the shank, the measurements being taken between the faces of the drawbar heads and inside faces of the knuckles. Loads of 75,000, 100,000 and 125,000 lbs. were then respectively sustained for a sufficient time to obtain the measurements of the knuckle openings, and the load was then increased to destruction.

The couplers were then removed from the machine, and an outline sketch was marked with the location of all fractures, and the knuckles were examined to see if they could be operated. The couplers which broke were then photographed, care being taken to bring out all parts that failed. After testing a set of couplers, in almost every case four uninjured bars remained, and these were used for single lug and drawbar tests in the following manner: Out of the four remaining bars the two best were picked, and, tailbolts being inserted, were coupled together, the upper lug of one to the lower lug of the other. The tail bolts were so adjusted in the machine that the faces of the knuckles were kept parallel, and the bars pulled to destruction. Outline sketches were marked showing the location of all fractures in the single lug test, and the breaking load recorded, and photographs taken. Drawbar tests—that is to say, drawbars without any knuckles—were then made as follows: The best remaining drawbars were then picked out, and the knuckle, pivot pin, etc., removed. A steel tailbolt was then inserted, and a special forged steel fixture, having a shank 3 in. square by 20 in. long for gripping in the machine, was coupled to the drawbar by a steel pin of high carbon in place of the knuckle. The drawbar was then pulled to destruction, and a record kept of the load required, also of the location of the fracture.

Photographs were not deemed necessary in the drawbar tests, as the description of the fracture was thought to answer every purpose.

In the drop tests it was shown that the steel not only had the advantage of being stronger than the malleable bar, but that it also was stronger than its knuckle, which is an important advantage, as the knuckle is the easiest and least expensive part to renew. The reverse is true of the malleable bar, it being weaker than its steel knuckle, as shown by the tests. This appears from the fact that of 75 couplers tested, 40 of steel and 35 malleable, out of the 40 steel couplers 6 knuckles broke on or before the second blow at 75 ft., and but one steel drawbar was broken. Out of 35 malleable couplers no knuckles were broken on or before the second blow at 15 ft., yet 27 of the drawbars were broken.

It was also evident that the shanks of the malleable couplers showed the most weakness, as 69 per cent. of the malleable bars broken broke in the shank, whereas only 35 per cent. of the steel bars broken broke through the shank. Holes in the malleable shanks for different purposes weaken them considerably, as many of them brake through such holes. This was not noticeable in the steel bars.

Wrought iron pivot pins bent so as to make the knuckle inoperative after a few blows; while with steel pivot pins, and the same construction of bar lugs, they were in some cases operative after 10 blows.

In the pulling tests the importance of a pivot pin of high carbon was clearly demonstrated, it being obvious that soft steel for this use was entirely unsuitable. For example, many bars had the pivot pins sheared off at a load much below what was actually required to fracture either the bar, knuckle or lock, or else had the pin so badly bent or sheared as to make the knuckle inoperative, and the coupler in this form entirely useless for service. Again, the destruction of the bar may occur by the use of a weak pin, as was shown by a pivot pin shearing off close to one drawbar lug, and then acting as a lever would fracture the other drawbar lug.

The single lug tests show in most cases that one lug was able to stand a load of over 90,000 lbs., although many stood over 125,000 lbs. The drawbars with knuckles entirely removed show themselves generally to be strong enough to stand a load of over 125,000 lbs., some standing as high a load as 200,000 lbs., and one breaking at 226,800 lbs. Very few shanks were broken, proving that they were amply strong to stand the yoke or tailbolt strain.

It might be well to mention here that some comment was made by several of the representatives present at our counting the clevis, pin and key as three parts, and more than one was heard to say that "had he known that this was to be taken apart and counted, he would have removed it before sending the couplers for tests."

Our reason for doing this was that we wished each part of the coupler to be recorded as it was fitted up ready for service, showing the number of parts that entered in to make up a complete coupler of each type.

It was found that most knuckles are weak through the pivot pin hole, and that steel pivot pins of high carbon should be used, greatly increasing the strength of the coupler. Simplicity being an important feature, it would be well to use as few parts as possible in coupler construction.

We regret that on account of the limited time we were unable to enter into guardarm tests as fully as we would like to have done, and feel sure that suitable tests can be devised to thoroughly test this part. We hear, however, that many guardarms are already being strengthened.

The prescribed M. C. B. specifications for the drop and pulling tests, we do not consider in any way too severe, and would advise that they remain the same.

A great deal of useful information conceaning the construction of a drop has been gathered from this test, as we found that it was impossible to keep the foundation from giving way, and we feel sure that were we given time we could construct one that would stand all the strains without injury. Two important facts in the construction of a machine of this kind were made evident: First, that the only proper form of bedplate to use is a large casting, the larger the better, but not less than 5 × 5 ft. square, containing enough metal to take up in the mass all shocks and recoil, and placed upon a steam hammer foundation. Second, that the only proper way to test a coupler is to hold it securely in the machine while it is being tested, and allow it to receive the full force of the blow, which we do not see can be accomplished in any other way.

The benefits derived from recent tests of this kind have already been demonstrated, as couplers that failed in the Chicago tests have been so strengthened by a change in material that they have been thoroughly able to stand the tests conducted by the Master Car Builders' committee.

We feel certain that if the Association would make application to the Chief of Ordnance for a drop test machine to be built at the arsenal at Watertown, there would be no trouble in accomplishing it, as this machine would not only be useful for the future work of the Association, but would also be useful for a great variety of government work, it being understood that a machine of this kind was lacking at the arsenal.

We wish to thank Maj. J. M. Reilly, commanding officer of the arsenal at Watertown; Mr. J. E. Howard, in charge of the tests machine, and Mr. E. K. MacNutt, who made all photographs of the pulling tests, for their many favors and kindnesses shown, not only to ourselves, but to the many coupler representatives present.

Sub-Committee { D. M. PERINE,
G. C. BISHOP.

Your committee has not taken the time to thoroughly digest this very interesting report from Messrs. Perine and Bishop, or to draw conclusions from it. They further beg to call the attention of the Association to the fact that so much has been accomplished by coupler manufacturers since the proposed specifications were formulated, and so much improvement has been brought about in couplers since the beginning of the tests, that even if they were ready to report definite specifications for the adoption of the M. C. B. A. they would not consider it wise to do so at present.

It must also be evident that the proposed specifications are in no way too severe, a matter which has been questioned by a good many.

It is also gratifying to know that the character of the tests will admit of two kinds of materials in the bars. The importance of this cannot be overestimated. Fewer openings and holes in the shanks of the malleable bars will materially aid them in meeting drop tests. Your committee has not been able to carry to a conclusion the guardarm test, nor have they taken any action on the increased dimension of the shank which was brought up last year. It is believed that a very decided step has been inaugurated in the matter of M. C. B. coupler investigations. What results will eventually be brought out it is difficult to foretell. That it will enable our managers and coupler manufacturers to better distinguish between good and bad bars we believe no one will dispute.

In conclusion the committee submits the foregoing as a preliminary report and requests to be continued for another year, when it is hoped sufficient data will be at hand for a final report.

Committee { J. M. WALLIS,
R. D. WADE,
G. W. RHODES,
J. H. MCCONNELL,
JNO S. LENTZ,
T. G. DUNCAN.

This report was accompanied by tables the substance of which is embodied in the following abstract:

Coupler.	Material.	No. of parts.	Pulling test. Aver. pull to break.	Pulling test. Single lug.	Pulling test. Bar test.	Drop test, aver. blow to break.
Chicago	O. H. Steel	7	180,400	154,600	209,500	17.0
Standard	" "	4	157,950	106,000	§	8.5
Buckeye	Mall. Iron	8	154,570	132,200	125,800	12.5
American	O. H. Steel	10	153,450	.. ....	219,900	6.8
Drexel	" "	7	152,300	120,500	214,100	7.3
Perfected	" "	11	146,925	127,100	.....	6 3
Brown E Link	" "	12	144,030	99,500	139,900	5.8
Trojan	Mall. Iron	7	132,850	98,500	143,600	3 8
Gould	" "	9	132,193	86,850	120,480	4.8
St. Louis	O. H. Steel	6	132,050	116,100	.....	4.8
Thurmond	Mall. Iron	8	130,125	107,600	.....	6.3
U. S.	O. H. Steel	5	126,650	137,100	226,800	16.3
Hinson	Mall. Iron	8	125,000	98,700	135,100	7 5
California	O. H. Steel	7	123,475	70,000	139,900	12.5
Rivers	" "	4	118 725	119,200	.....	1.8
Janney	*Mall. Iron	10	90,413	71,400	135,200	4.3
Johnson	† "	11	71,800	59,900	117,700	3.5
Ludlow	"	12	69,375	50,800	79,950	....
Williams	"	....	.....	.....	.....	6.3
Empire	"	....	.....	.....	.....	4.5

* Wrought iron knuckle.
† Malleable iron knuckle.
§ No pinhole.
When not specified, knuckles were steel.

DISCUSSION ON TESTS OF M. C. B. COUPLERS.

Mr. WAITT: I move that the Secretary be authorized to put the report in print and distribute it to the members of the Association as soon as it can conveniently be

done without waiting for the publication of the annual report. Carried.

Mr. MARDEN: As this is one of the cases where a committee has done a great deal of work for the benefit of the Association, I move that thanks of this Association be given to the committee for the very able report that they have given us, and that we encourage them in the work for the coming year. And to the Pennsylvania Railroad. The motion was seconded by Mr. Adams and carried.

DISCUSSION OF REPORT ON CAST IRON WHEELS.

[This report was printed last week.—EDITOR.]

Mr. MITCHELL: I would like to ask if the answers received to the circular letter which favored the contracting chill were not from roads that used the contracting chill entirely.

Mr. WEST: No; there were not more than two that had adopted the contracting chill entirely. Most of them were using the contracting and the old solid chill.

Mr. BARNES: I would like to ask what is meant by the contracting chill. There are several forms of subdivided chills that are often called contracting chills, and there is only one chill that is properly called the contracting chill, and that is the Bar, contracting chill. Another matter forgotten entirely in this report is the great improvement in rapid pouring; the great recent improvement in wheels is very largely due to that.

Mr. WEST: Our replies were confined almost entirely to the Whitney and the Barr contracting chill. I would say that that was one of the points raised by the majority of the replies, that the contracting chill allowed a hotter and more rapid pouring of the iron.

DISCUSSION OF REPORT ON STEEL TIRED WHEELS.

[This report was printed last week.—EDITOR.]

Mr. MITCHELL: I would prefer to see this committee continued for another year until they can get information on the Paige wheel, and place it in with this circular. The Paige wheel is used very extensively throughout the country and is giving good service, and I presume there are as many of those wheels in use in the country as of any other kind unless it may be the Allen. I would move that the committee be continued another year and that they embrace all steel tired wheels in their report.

Mr. BISSEL: The vital points that we want are not embodied in this report. We want the wearing quality and the durability of wheels and their liability to accident. There are many different forms of wheels; some have a centre that is indestructible, and some have a centre which would burn up. It seems to me the most desirable wheel—that is, the most durable—that gives the best service, and that is the most safe, should be pointed out. Which is the most desirable wheel—the most economical and safest to use? is what we want to know.

Mr. MARSHALL: Last year the committee found it impossible to get information to enable them to make a satisfactory report, as it seemed that a majority of the railroads of the country kept their record of steel-tired wheels to show almost entirely the wear of the tires, and with very little relation to the various types of centre; and I think that if the committee should take it up again they would find the same state of affairs that they did then. If the committee is to be continued to do that, we would be very thankful for any suggestions.

Mr. ADAMS: It is desirable for the Association to know the percentage of breakage of different wheels, both tire and centre, and the comparative mileage of wheels and the kind of tire that is used to produce this mileage. Those questions are all important. While it would be perhaps difficult for some roads to give this information, there are others who could and would.

Mr. RHODES: It is the general impression that a steel-tired wheel is a very safe thing and a very good thing to use. I am not of that opinion. The experiments that we have made and the experience that we have had in steel tired wheels do not lead us to draw the conclusion that they are the best wheels to use. We know that in the matter of brakeshoes and tire wear a successful effort has been made to dress down the parts of the steel tires which do not come in contact with the the rail, and an effort is made not to use shoes on the parts that do come in contact with the rail. On many Western roads, and especially on the hilly roads where they largely introduce steel tired wheels, the rail wear is very materially affected. I know of several lines where they have been obliged to abandon the use of steel tired wheels on account of the excessive wear, particularly of the flange of the wheel and incidentally of the rail. We know the action of sleeping car companies recently in reducing the diameter of their wheels, and must know there is some cause for it. The cause is that the flange does not wear well. We are constantly having to turn tires, not for tread wear, but for flange wear I have no doubt there are many here who, if they cared to speak about it, would say that they had tried steel tires for engine trucks and have done away with them and put back cast iron wheels. It will pay to look after our wheels, and the endeavor should be to raise the value, increase the service of our cast iron wheels, and not necessarily jump to the conclusion that the steel tired wheel is the best. I thought that steel-tired wheels mounted on wrought centres would never break. Our last year's experience was that wheels with wrought centres broke as often as cast iron wheels, perhaps not quite as often, because we did not have quite as many wrought centre wheels as cast iron wheels. But my idea that we were going to get a wrought centre wheel that was going to last forever has disappeared entirely. They are not going to last forever, and it is a serious question whether we ought to pay $40 or $50 for them when we can buy a wheel that will give a large mileage for $8 or $9.

Mr. BISSELL: My experience is that by using a brakeshoe that fits over the flange of the wheel that rail shearing is avoided. In the last seven years we have been using the flange brakeshoe. We never have found a pair of wheels where that was used continuously come in in a condition to shear off the edge of the rail.

I was with Pullman Company at the time that they adopted the steel wheel, and since I have been with the Wagner Company we have adopted them entirely. But the question now before us is what is the best steel-tired wheel. It is not whether steel-tired wheels are better than other wheels. My private opinion is about the same as Mr. Rhodes.' I know that within a week we have had a tire break on a new steel wheel—a new wheel that had run but a trip or two.

Mr. ADAMS: Please tell us whose steel tire that was.

Mr. BISSELL: It was not made in America.

Mr. WAITT: We have many wheels taken out of cars on account of bolts loose or bolts partially sheared, also on account of the tire revolving on the centre and not being held properly in place; further, because the application of the brakes has injured the centre so that it does not back up the tire. I begin to believe that there is a great deal in the proper kind of centre, especially as I have found that one road has had experience with about 14,000 of a certain kind of centre, and has not had in eight years a single failure. I believe if the committee would inquire about the failures due to defects in the tire or within the tire, and failures due to peculiarities in the centre, it would develop a very interesting state of things.

Mr. ADAMS: Many breakages could be easily accounted for by too great a shrinkage on the tire: when the blows begin to pound upon it the strain is too great. We never have had in our experience any serious accident from the breakage of a steel tire during the whole time we have used them, some 23 or 24 years. I do not say that we have not had a break, but I say that we have never had an accident resulting from them. One feature of the steel wheels that makes them preferable to iron is that a defect in them can always be discovered before they fail, if proper inspection is used, while with cast iron wheels it is not so. On heavy graded roads brakes applied for any considerable time and extent will, of course, elongate the tire by heating it up and loosen it to a certain degree, and if it is a bolted wheel the chances are that it will shear the bolts. If it is not a bolted wheel it would not be subject to that objection, though the tire might be loosened and moved on the centre. I differ with Mr. Rhodes in regard to iron wheels being the cheapest.

Mr. BARNES: I move that the committee be instructed to report next year on the number of parts, weight of tire, weight of centre and method of tire fastening, illustrated by drawings, and the liability of the tire and parts to get loose, and describe a process of re-tiring—with reference to the wheels mentioned in the report and such additional wheels as are in the market. Seconded.

Mr. WEST: We have at our Middletown shops to-day 75 defective steel-tired wheels, and only two of them are from defective tires. The others are failures of centres.

Mr. HAYWARD: The committee should include a limit of wear of tires. There is a great difference in the strength of these tires by the method of construction and the method of application. Motion carried, and three additional members were added to the committee.

SESSION OF FRIDAY, JUNE 16.

The Secretary read a letter from Mr. C. A. Hammond, Secretary of the American Society of Railroad Superintendents, requesting the Master Car Builders' Association to send delegates to the next meeting of the American Society of Railway Superintendents. This was referred to the executive committee for action.

REPORT ON FREIGHT CAR TRUCK FRAMES.

We did not consider the Association desired the Committee to make recommendations for a standard freight car truck, but to get an expression from each member as to what particular design of truck be favored, and dimensions and locations of the most prominent and vital parts commonly used in a rigid or swing bolster truck, and to call attention to facts based only on reports received, showing defects and deserving merits which in our opinion would be of value to the Association, or perhaps the "entering wedge" for a future standard truck.

The committee issued a circular letter to all members, which was answered by only about 25 per cent.

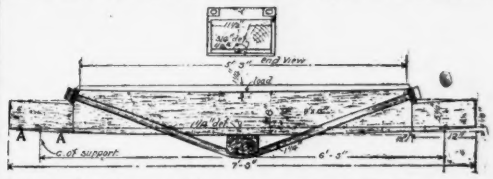
It is believed by your committee that, if arch bars, tie straps, column bolts, truss rods, springs, etc., could not be made of a standard uniform shape and design, a standard dimension of material used in these items could be agreed upon for use in trucks constructed for cars of 40,000 to 60,000 lbs. capacity.

Your committee is also agreed that while a large per cent. of the present design of trucks, and especially those made prior to 1887, have many parts that are of faulty construction, there are also many trucks with dimensions and weights of parts greatly in excess of requirements, the result of which is to unnecessarily increase the dead weight.

We would recommend that it would be wise for this convention to consider the subject with view of adopting standard dimensions of steel and iron arch bars, bolts, truss rods and material in elliptic springs, to be used in truck construction for cars of 40,000 to 60,000 lbs. capacity, of such a design as to admit these parts.

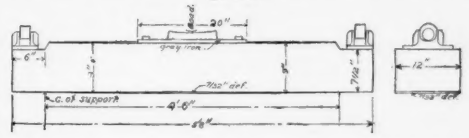
It is also believed that a large variety of dimensions for timbers used in bolsters and transoms of modern design of truck could be reduced and brought nearer to a standard.

The possibility of adopting throughout a standard design of truck appears at this time very distant, as progress and improvement in car trucks are rapidly being made. In fact, the old design of swingbeam and rigid trucks, composed of shrunken, treacherous woods and common gray iron, with an almost endless number of parts which, when derailed, break into fragments like so much window glass, are rapidly becoming obsolete, and there is every indication that they must soon be entirely eliminated. It is noticeable that much of the new equipment is being provided with wrought iron and steel trucks, so designed and constructed as not to materially increase the first cost and to reduce the number of parts and dead weights, cost of maintenance, loss of life and other damage claims, caused by weak and defective trucks.



A A—Springs, inner coil, ½ in. permanent set. Load on centre, 25,000 lbs. Deflection, 1⅜ in. Permanent set, 1¼ in.

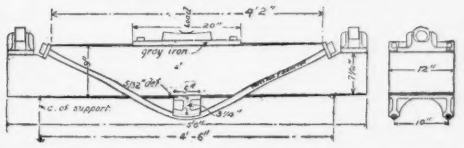
Rigid truck bolster car of 50,000 lbs. capacity; in service two years.



Load on centre.	Deflection.	Permanent set.
20,500 lbs.	5/32 in.	1/32 in.
22,000 "	3/16 "	1/16 "
25,000 "	7/32 "	1/8 "

Capacity of car, 40,000 lbs.

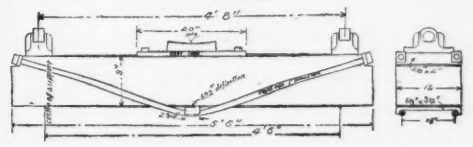
All wood bolster for wooden body bolster.



Load on centre.	Deflection.	Permanent set.
20,500 lbs.	5/32 in.	0
22,000 "	3/16 "	1/32 in.
25,000 "	7/32 "	1/16 "

Capacity of car, 40,000 lbs.

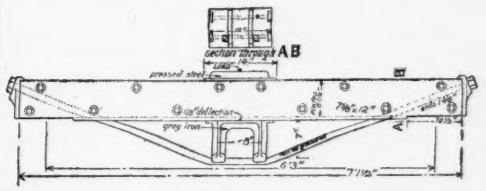
Wood bolster trussed inside of side-bearings for wooden body-bolster.



Load on centre.	Deflection.	Permanent set.
20,500 lbs.	5/32 in.	0
22,000 "	3/16 "	1/32 in.
25,000 "	7/32 "	3/32 "

Capacity of car, 40,000 lbs.

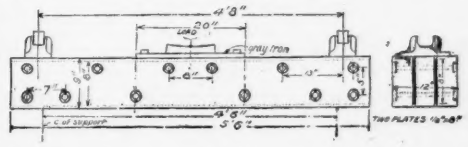
Wood bolster trussed outside of side-bearings for iron body-bolster.



Load on centre.	Deflection.	Permanent set.
15,000 lbs.	3/32 in.	0
20,000 "	1/8 "	0
25,000 "	5/32 "	0
35,000 "	7/32 "	0

Capacity of car, 60,000 lbs.

Combination trussed bolster. Two ¾-in. plates 6½ in. wide; two truss rods 1⅛ in. diam.



Load on centre.	Deflection.	Permanent set.
20,500 lbs.	3/32 in.	0
22,000 "	1/8 "	0
25,000 "	3/32 "	0

Capacity of car, 40,000 lbs.

Combination bolster (two ½-in. iron plates) for iron body bolster.

Bolster Tests—With Report of M. C. B. Committee on Freight Car Truck Frames.

Your committee respectfully submit the following in reply to our questions in circular number, to which we received answers in part from 53 members of the Association.—[Questions and answers omitted—EDITOR.]

Question 1, 2, 3, 4 and 5 and answers demonstrate that rigid trucks are fast superseding the old style swing truck, designed with bolster supported and suspended in vertical hangers to produce lateral motion, the change mainly due to the increase in number of parts of the old design of swing truck, which rapidly wear out.

Answers to Questions Nos. 6 and 7 call out the fact that a large number of railroads have not had experi-

ence, nor are making any test of a modern swing truck, and a number of those who are using and making test of them under cars of 60,000 lbs. capacity have not had them in service long enough to furnish report, but hope to be able to do so a year later, which we decide will be valuable. Your attention is also called to the item of difference reported in cost and maintenance of old style swing and rigid truck, in favor of the latter.

Nearly 90 per cent. of the members who reported express themselves as in favor of a certain amount of lateral or vibratory motion for passenger cars. The question naturally arises, if these requirements are needed for passenger cars, why are they not good for freight cars as a greater protection against damage to freight, which is frequently injured by rough riding of cars, and to lessen lateral shocks of rolling stock against track and rail? and we would therefore respectfully recommend that tehse questions be carefully considered by all the members.

13. If swing bolster trucks are considered a greater element of economic results as to decrease of wear of wheel flanges, brasses and journals and to decrease of wear and tear of track and to carry car body more steadily than rigid trucks, would you not prefer to adopt them for freight cars, providing it did not increase the cost of construction and maintenance over that of rigid trucks?

A. To this question 90 per cent. of those who replied answered yes; seven answered no, or in favor of rigid trucks for cars of 60,000 lbs. capacity, and two undecided.

Your committee would particularly call your attention to this popular and almost unanimous expression in answer to Question 13, and from information received we are safe in saying that the mechanical world is now about ready or has already started to introduce two or three good practical designs of trucks which we think will favorably meet this expression of the members, also the approval of those railroads who are wide awake to adopt improvements which will produce safety and economy.

14. State from experience if you consider truck check chains desirable as a factor of safety in cases of derailment?

A. Forty answers received to this question; 14 consider truck chains desirable as a factor of safety in derailments; 26 consider them of no value whatever.

Your committee also received some correspondence relating to truck chains, the majority indicating that they did more damage than good. It is a well-known fact that in cases of freight trains parting and running together or in collision, as well as derailments, the car body will be forced into nearly all imaginable shapes and positions, regardless of whether they are fitted with check chains or not, and you have, without doubt, noticed cars with many split sills and twisted truck frames, due mainly to the fact that trucks and car body are tied together with check chains. We estimate that a set of check chains and their fastenings, well made and applied to each corner of truck and properly attached to the car, will cost $4.50 per car, and the best estimate we can get as to cost of their maintenance per annum for repairs and renewals is about 12 per cent. of their cost, which, when added to the original investment, shows an expense, we believe, worthy of further consideration of the members, to recommend whether check chains should be maintained or eliminated altogether.

From answers to circular and other information gained from members, your committee decide that a trunk can be constructed with a greater capacity at less expense by designing a truck with springs resting as near as possible in the centre of the frames or arch bars and journals, which are considered the foundation of the trucks. One of the committee personally inspected 63 different cars belonging to various lines, and particularly noted that those trucks designed with springs resting in the centre of frames were in much better condition than trucks built with springs located away from the centre liue of truck frames and journals.

The object of your committee in submitting certain other questions was to gather information, if possible, in regard to the carrying capacity of the different designs of bolsters, as it is a well known fact that fully 50 per cent. of those applied under cars prior to 1887 have no factor of safety for carrying a load equal to or greater than the intended capacity of car, without deflection at the centre sufficient to transfer a large per cent. of the load from centre plates to side bearings, producing expensive and dangerous results, familiar to many of us. The majority of members express themselves as having difficulty with weak bolsters, and a number also state the defect had, in their opinion, caused derailments on account of trucks not curving freely; your committee therefore decided to make a few tests of bolsters, the results of which are shown in diagrams herewith.

Many trucks of resent design show a decrease in parts of nearly 20 per cent., while a few others have evidently not given the subject of reducing parts much study, and we strongly recommend that the question of reducing number of parts in car trucks be carefully considered, as there are many cases where the life and capacity can be increased, and the first cost and cost of maintenance reduced a very large per cent. by so doing.

The committee made personal inspection of 61 different styles and makes of freight trucks, largely composed of wood transoms and bolsters, and every truck was more or less defective on account of the parts shrinking, causing loose bolts, and many other parts split, checked, cracked, splintered, worn away, warped, etc., and we therefore recommend that timber not thoroughly seasoned is unfit for car truck construction to produce economic results, and as builders cannot use seasoned timber, we would recommend the introduction of steel or wrought iron in place of green unseasoned timber.

28. In your experience, gained from observation and test, is not an iron or steel truck cheaper to maintain than a wooden truck?

(A.) Thirty-nine replies received; 29 claim a steel or iron truck is cheaper to maintain than wooden ones; 10 say they are not.

Some very interesting information was received by the committee on this subject, which leads us to recommend that a good design of wrought-iron or steel truck can be maintained for about 18 per cent. less than the best design of wood truck, and especially many of the swingbeam patterns.

29. What, in your opinion, is the proper wheel base for a four wheel freight truck, 4 ft. 8½ in. gauge?

(A.) Information received on this subject gives a majority in favor of wheel base being 5 ft., a number would prefer the wheel base 5 ft. 3 in. to 5 ft. 6 in., for inside connected brakes for cars of 60,000 lbs. capacity.

30. Assuming 5 ft. as the maximum wheel base, of what size bar iron would you make the top and bottom arch bars and tie strap in a 60,000-lbs. capacity truck, with a camber of 15 to 18 in. between arch bars?

(A.) To this question 39 members replied; 23 answered that their standard top arch bars were 1¼ × 4 in., bottom arch bar 1⅛ × 4 in., and tie strap ¾ × 4 in. Eight members report that they prefer top arch bar 1⅛ × 4 in., and bottom arch bar 1 × 4 in., and tie strap ¾ × 4 in. A few were using 1⅝ × 4 in. for top arch bars, and 1 × 4 in. for bottom, and ¾ × 4 in. tie straps.

All of the above dimensions were reported as being entirely satisfactory; and if such is the case it is evident to your committee that some of the arch bars in use are excessive in dimensions and weight.

31. What size would you recommend for the diameter of truck column bolts for cars of 60,000 lbs. capacity?

(A.) Thirty-eight members answered this question; 29 would recommend 1¼-in. bolts, five 1⅜-in., and four would recommend 1½-in. bolts.

The replies show a preference in favor of 1¼-in. column bolts (four to each truck), and your committee is of the opinion that if 1¼-in. column bolts are made with a good fillet under the heads they will be entirely satisfactory for service for trucks of 60,000 lbs. capacity.

32 To secure column and oilbox bolts, do you prefer double nuts or one nut secured by round spring cotter, or tapered flat split key for each of these bolts? or do you prefer nut lock?

For lack of information from members, your committee has no comments to make other than that the majority expressed themselves as in favor of securing bolts with one nut and spring cotter. A large number were either using or testing various designs of patent nutlocks.

33. In your experience in securing single nuts with spring cotters, do you not have difficulty in getting spring cotter to lock against the nut closely, on account of the varied distance caused by shrinkage of castings?

(A.) Thirty-nine replies received to this question; 29 as having difficulty mentioned; 6 no difficulty, and 4 have had no experience.

Your committee inspected a large variety of equipment from one to two years old, and found many of the bolts locked as mentioned (in Question 33), with loose nuts, on account of the shrinkage of timber and gray iron castings which varied the distance between cotter and bolt heads, and your committee would therefore recommend that the bolts be locked with double nuts or a steel nutlock of good and safe design.

34. Are you in favor of inside brakes suspended to the truck frame, or outside brakes suspended to car body?

(A.) Forty members replied to this as follows: 26 in favor of suspending brakes to the truck; 14 in favor of suspending brakes to car body.

A large portion of the rolling stock, designed in the past three or four years, is equipped with inside brakes suspended to the truck transoms. Quite a number of the members stated that brakes suspended to the truck frames are cheaper in first cost and cost of maintenance, and will aid in preventing brakeshoes from wearing against wheel flanges, which is usually the case when they are hung to the car body, due to the swaying of car body more particular when on curves.

35. Do you not consider metal brakebeams more economical than double trussed wood beams on trucks under cars equipped with air brakes?

(A.) Thirty-eight members replied to this question; 27 consider metal brakebeams more economical than double trussed wood beams; 11 consider a double trussed wood beam more economical.

Your committee received several statements as to cost and maintenance of metal and double truss wood brakebeams for air brake service, which leads us to decide that metal brakebeams are as cheap in first cost, and are from three to seven per cent. cheaper to maintain, than double trussed wood beams.

The committee has no new information to report relating to the Fox solid pressed steel truck. Quite a large number of the lines using the truck were not able to express a decided opinion, on account of the truck not being in service long enough. The majority of the members believe that the introduction of pressed steel for freight car trucks is a move in the right direction, and will produce economic results worthy the consideration of the Association. We would call attention to the almost unanimous expression that elliptic springs and vibratory motion are desirable in special cases.

44. In a swing bolster truck, what distance do you allow between the end of bolster and intervening truck transom castings or frames, this distance to be considered the limit of the swing motion of bolster?

(A.) Twenty-six replied to this question; 13 allow a distance of 2 in. at each end; six, 2½ in.; two, 1½ in.; two 1 in.; one, 4 in.; one, 3 in., and one 1¼ in.

From the best information received from members, and decisions arrived at from practical tests of both freight and passenger cars of the spring bolster pattern, we find that the lateral motion of bolster rarely exceeds one inch each way from the centre, and your Committee would recommend this distance as meeting all requirements.

45. In a swing motion truck, do you apply truck hanger bracing by setting the lower end in or out, or in a plumb line? If in or out, state distance from plumb line.

(A.) Your committee received 31 answers to this question; set truck hangers 1½ in. outward from plumb line. The balance of the information received was not made clear enough for further report.

46. State dimensions of plain oak (not trussed) truck bolsters, if you use them, in your rigid or swing truck for cars of 40,000 lbs. capacity.

(A.) Thirty-seven members replied. Dimensions of plain oak bolsters as used by the different members heard from are as follows: Two, 9 × 12 × 64; one, 8 × 12 × 90; one, 9× 10½ × 68; one, 10 × 10½ × 66; one, 9 × 12 × 87; one, 9½ × 10½ × 69; one, 8½ × 11¼ × 66; one, 10 × 12 × 60; one, 8½ × 12 × 90; one, 10 × 12; one, 9 × 12 × 65. Twenty-two members used bolsters trussed.

Your committee tested the largest and average size, the result of which satisfies your committee that the deflection at centre of bolster, under a load of 40,000, in addition to load of car body, was of an extent to cause us to decide that none of them had any factor of safety whatever and allow free curving of the truck.

47. Inasmuch as truck bolsters are located under the car and required to receive the weight of car and load direct, and cannot be repaired or adjusted without detention to the car to remove the truck, is it not therefore important that truck bolsters be constructed with a view of securing a greater factor of wear and safety than many of those at present in service?

(A.) Thirty-nine answers received, all in favor of truck bolsters being constructed with view of securing a greater factor of wear and safety than many of those at present in service.

Your committee has nothing further to add in answer to Question 47, except to say that there was a general expression that it is very important truck bolsters be constructed with view of securing a greater factor of safety, and many freely stated that they found more defects in bolsters of freight trucks than in any other item about the truck.

49. From experience, do you find the standard M. C. B. journal box, lid, brass and key satisfactory?

(A.) Thirty-nine answers received; 18 find the M. C. B. journal box, lid, brass and key satisfactory; 21 do not.

As the subject of journal box lids is being considered by a special committee, your committee on Trucks consider further report unnecessary.

50. Judging from present and past experience, would you recommend wrought iron or steel freight trucks to be more economical than a truck constructed of gray (cast iron) iron and transoms and bolster of wood?

(A.) Forty-one members replied to this question; 13 recommending freight trucks all of steel; 8 are in favor of pressed steel; 9 are satisfied with present style of truck; 3 recommend wrought iron and steel; 2 recommend wrought iron trucks; 1 is in favor of cast steel of the "basic" process, and 4 believe that some radical improvement is necessary.

Your committee also received considerable information as to first cost of maintenance of the common wood and gray iron truck of the "diamond" pattern, as compared with the modern freight truck, composed largely of wrought iron and steel. Reports show that the first cost of the latter trucks is considered from 5 to 15 per cent. greater, but that this is fully offset by the difference in cost of maintenance in one or two years' service.

In conclusion, your committee would call attention of members of the Association to the importance of a much needed improvement in car trucks, which are not, in our opinion, in many cases keeping pace with the dimensions and capacity of car bodies, and we therefore recommend for your consideration for improvement a few of the most vital points in trucks intended for cars of 40,000 and 60,000 lbs. capacity.

1. Uniformity in dimensions (except length) of materials used in arch and tie bars. Transom and bolster truss rods, oilbox and column bolts; side bearing and center plate bolts; spring steel used in elliptic springs; iron and steel truck transoms.

2. Truck bolsters made and designed with a sufficient factor of safety to carry the marked capacity of the car without deflection enough to disturb free action of the side bearings.

3. That many of the trucks need to be redesigned with a view of diminishing the number of parts fully 25 per cent., thereby reducing first cost and maintenance.

Committee { J. C. BARBER, W. S. MORRIS, S. A. CRONE.

DISCUSSION OF REPORT ON CAR TRUCK FRAMES.

Mr. SANDERSON: I wish to compliment the committee on the thoroughness of the report. The experience we have had with pressed steel centre plates has not been altogether favorable. Members know what the result would be of bending a flat piece of sheet iron in the centre with a hammer—the edges all curl up. The centre plates we have used have shown that trouble. The downward pounding on the centre has caused the plates to curl up until they pulled out from the wood entirely, and they got to jiggling on the bolsters and sawed off the heads of the bolt. I believe that a solid centre plate would be better. I mean a centre plate of solid metal with more thickness to it, so that it would not saw the bolt.

Referring to question 22, as to fishplate bolsters, there is a weakness in the fishplate bolster that was not brought out by the question. The three narrow strips of wood and the two fishplates placed between have very little lateral strength. If a car with such a bolster runs against an end stop, the centre of the pin bends laterally. When the wood shrinks a little, the narrow iron plates standing on end are unsupported, and they buckle and give way under load. I find that with the ordinary oak we can get for car bolsters there is a shrinkage anywhere from three-eighths to one-half an inch, in 12 in., inside of 18 months. You can see that we cannot expect good results from any combination of iron and wood where the wood is going to shrink like that, and where the iron depends on the backing of the wood.

Referring to Question 25: I am not convinced that it is not practical or quite feasible to get at the results that we want with the use of a nut and a split key, provided the split key is properly formed. To make up for little differences in the castings and roughness of the arch bar, the key is given a slight taper.

Referring to question 30: Many arch bars are made unnecessarily heavy on account of the misunderstanding of the matter. For convenience in shopwork the bends of the archbars are made unnecessarily long and are kept away from the castings around which they are supposed to hug, as it were. Consequently, there is a weak place right where this bend is. If they were bent close up to the casting and the angle well supported, breaking would never take place.

Bottom tiebars are generally too thin, sometimes ⅝ in., sometimes ½ in., sometimes ¾ in. The holes are punched mostly. The bolt is not made unnecessarily long. The threaded portion of the bolt is in the hole. The thread is cut back along the bolt far enough to be sure that the end will not bottom in the thread before it pulls up tight. Consequently the whole bearing of the bolt in the bottom tiebar is on the thread, and we find in taking those bolts out and renewing them that the thread is sawed away on the outer edges of the holes, leaving the boxes to spread out. The holes should not be punched, but should be a neat fit on the solid section of the bolt; and if necessary the bolt should be made longer and the washer applied underneath so that the threaded portion of the bolt can be kept entirely below the bottom tiebar.

Mr. RHODES: I do not know of any more complete way of burying a test than to apply it under a freight car. It has been our practice for some years to make our tests under tenders. In a good many cases we have had curious replies from persons interested in the devices that we were testing. They have told us that some things were not intended for tank tests; that they were not strong enough for that service; that they were intended for freight service. Now if I had put those devices under freight cars they would have been buried, would have been lost sight of. The returns we get under a tank in three or four months would take three or four years to get from a freight car. I commend the committee very highly for their report.

REPORT ON AIR-BRAKE TESTS.

[No cuts ready, consequently portions of the report are omitted now.—EDITOR.]

In your committee's report of last year attention was

called to the fact that they were lacking in an essential feature necessary for successfully carrying on the investigations assigned to them, viz., a pipe rack, gauges, recording apparatus, competent assistants, etc. It was also stated that the Pennsylvania railroad had offered to establish for the Association at its Altoona shops a complete set of brake-testing apparatus for the purpose of investigating and reporting upon the different triple valves now on the market or which may develop in the future. It gives your committee great pleasure to announce that this promise is now an accomplished fact. On May 1, 1893, the Pennsylvania railroad turned over to your committee a building completely fitted with every detail desired and which may be briefly described as follows:

The building is 40 ft. by 80 ft., put up in a very substantial manner with timber framing, the outside covered with corrugated sheet iron, of which material the roof covering is also made; the inside of the building is sheathed with wood. In a small annex is located a vertical boiler of abundant capacity to work the air pumps and heat the building; it is constructed to carry a steam pressure of 160 lbs. and is fitted with all the necessary appurtenances.

The main building contains at the present time one test rack upwards of 64 ft. in length, constructed of timber framing and erected to carry two sets of 50 freight air-brake cylinders and auxiliary reservoirs, each set with a complete outfit of tender and driver brakes with their auxiliary cylinders and two main reservoirs. Room is provided at one end for two air-compressing pumps and two engineer's brake valves; one of each of those is only now in place. One hundred brake cylinders and auxiliary reservoirs received from the Westinghouse Air Brake Company are placed in two horizontal rows of 50 each, one above the other; the upper set only is fitted with triple valves of the standard Westinghouse quick-acting type, the lower set is not fitted with triples, as that is the only one upon which the triples which are to be tested are to be placed; both sets have, however, all the other attachments required for service. The piping is the standard for 34-ft. freight cars, of the same diameter of pipe, the same length of pipe as used in service; it is fitted with the standard angle cocks, air brake and couplings, the standard drain cups and stop cocks, and with the same number of elbows as used in service; the only addition is a three-way cock connecting the 1-in. branch pipe with the two set of brake cylinders. This addition was necessary, as it was concluded that in order that both sets of brakes and triples should be tested under precisely similar conditions only one set of train pipe should be used for both. The 1-in. three-way cocks are connected to the triples by means of 1-in. rubber hose. The pipes for the engine and tender equipment are of standard size and lengths and arranged as nearly as it was possible to do so in the same manner as used on a consolidation locomotive.

The test rack containing the two sets of 50 brakes is placed to one side of the building, in order that at some future time a second rack facing it may be erected in the same building, and thus make it possible to test 100 sets of brakes at one time.

In order that the provisions of the specifications for the testing of the air-brake apparatus recommended by last year's committee should be carried out, each cylinder is fitted with a device for limiting the stroke of the piston. This device consists of a hinged strap which is attached to the cylinder head, and which can be thrown into a vertical position and out of the way when a full stroke of 12 in. is to be had; when the 6-in. stroke is to be used the straps are thrown into a horizontal position, and wooden blocks dropped into them, against which the piston rod strikes and limits the stroke. A small rubber plug is introduced in the end of the strap and acts as a buffer and reduces the shock. To obviate the danger of fracturing the heads, the Westinghouse Air Brake Company very kindly had special heads made of extra thickness and double the number of bolts by which the head is fastened to the cylinder. The blocks used are 2 in. in thickness, and when it is required to limit the stroke to 4 in. one additional block is introduced into each strap. In order that the force of the blow should be directly on the piston and not on the end of the tube-shaped piston-rod, special cast iron push rods were made and introdueed which offer some considerable surface at the outer end to receive the blow. When the full stroke of the piston is to be had and the straps are thrown out of the way, the push rods are removed.

As it is necessary to obtain correct records of the time elapsing between the movements of the engineer's brake valve when applying the brake, the movement of the twenty-fifth piston, the movement of the fiftieth piston and the attainment of 55 lbs. pressure in the fiftieth cylinder, special apparatus had to be introduced, and, as those time intervals are very small, it was, of course, necessary to make use of electricity for transmitting the movement of the various parts to the recording apparatus. The record is obtained by means of a chronograph consisting of a paper-covered drum driven by a weight through a train of wheels, uniform speed of the drum being controlled by a pendulum governor; the chronograph is made by Fauth & Co., of Washington, D. C., and is of great accuracy. In front of the revolving drum is placed a carriage which contains the marking pen and the electromagnet necessary for moving this pen; the carriage is moved in the direction of the axis of the drum parallel to it by means of a screw driven by the same train of wheels which drives the drum, in such a way that were the pen not moved by the electric current it would trace a continuous spiral on the paper with which the drum is covered, which, when the paper is removed from the drum, appears as a series of parallel lines ruled upon it. In order to obtain records as nearly instantaneous as possible, a closed electric circuit is used; in other words, the various devices located upon the engineer's brake valve and the brake cylinders in transmitting the movement of the apparatus break the otherwise continuous circuit and release the armature of the electromagnet on the chronograph. This armature is attached to a small lever, at the other end of which is mounted the pen and allows a spring to pull it away from the magnet every time the current is broken and the armature is released, the pen makes a corresponding movement in the opposite direction and makes a little jog in the otherwise straight line traced on the paper drum; as the circuit is broken by the movement of the various parts of the apparatus in applying the brakes a series of jogs are traced upon the paper and as the speed of the drum is constant a measurement of the distance between jogs in the line indicates the time elapsing between the movement of the various parts.

The circuit-breaking device placed upon the engineer's brake valve is shown on plate 4 and consists of a curved metal frame attached to brackets by which it can be clamped to the engineer's brake valve, and of a contact spring which is attached to the handle of the valve. . . .

Besides the apparatus above described, the rack is fitted with the requisite number of gauges as required on the cylinder and auxiliary reservoir of the first, twenty-fifth and fiftieth cars.

Your committee last year submitted for consideration a schedule or table entitled "Standard of Efficieney of Air Brakes." It was not recommended for adoption by the Association. The tables were intended only as an outline to be worked over and improved upon; nor is your committee prepared at the present time to submit any final recommendation. The inauguration of the World's Fair has stirred the different air brake companies up to the importance of becoming exhibitors and showing their apparatus in operation as nearly as can be under similar conditions to actual train service. The thousands of railroad men who attend the World's Fair this year will find a most wonderful exhibit of quick-action air brakes and recording apparatuses, the latter so essential in measuring performances, the value of which is computed in seconds and fractions of a second. Four brake companies have exhibits of racks represented as being the equivalent of different numbers of 34-ft. cars in service. Two companies show the equivalent of 50 cars and two actually show the equivalent of 100 cars. Such an opportunity for investigating the relative merits of so delicate a device has never before been presented to mechanics. These devices will be on exhibition six months. It is expected that much information will be gathered through the various experts who will examine them during the coming summer. It is well known that additional cars magnify defects in brakes that are not apparent in a small number. Your committee's rack so far is provided for but 50 cars. In view of the information likely to be gathered from these World Fair exhibits it was therefore thought prudent not to attempt to establish a final "standard of efficiency at the present time but to report progress, ask to be continued and defer a final report until 1894."

There are other matters, however, in investigations of this kind which must not be lost sight of. In the assignment of duty to your committee it will be observed that much stress is laid on the importance of carrying on the brake investigation in such a way as will insure "the best available service." Shop investigations are very important, but they are of little value unless associated with tests of service. Some of the best and most ingenious devices that have been invented have been ruined by neglect. Let us then consider whether there are any tests of service that should be claiming our attention. At this meeting we have representatives from almost every railroad company in this country. Only once a year are we privileged to criticise and to personally call each other's attention to details of practice. This will always be one of the great advantages of the Association, for it is through our members that we are able to reach the thousands of men on whose care and attention to maintenance depend largely the success and usefulness of the various measures and devices that we as a body have indorsed.

The mechanism of the triple valve is fine and delicate, and if not properly cared for will, for obvious reasons, become inefficient. Various efforts have been made to keep the dust, dirt and rust that accumulates in the train pipe out of these delicate parts. The first attempt at keeping this dirt out of the triple we find in a horizontal or vertical screen located in what is known as the train pipe drain cup. Formerly this drain cup was packed all around the screen with small pieces of sponge. Exhibit 1 is one of these drain cups; it is packed with sponges all around the screen. The sponge has become so solid it is difficult to pick out. A perforated bush is intended to prevent the sponge from going into the pipe leading to the triple. At the entrance to the triple, as a further precaution, we find a cup-shaped screen, as indicated in fig. 6. With the advent of the quick-action brake it was found very essential to reconstruct the train pipe and its connections, removing all sharp corners, angles and obstructions that existed, the sponge in the drain-cup among other things being banished as not conducive to quick action. Either through neglect or through zeal in the pursuit of quick action, some drain cups have been put in service not only without sponge but without any screen. Let us see the effect of this by examining some triple screens that were removed from freight cars so fitted after a few months' service by one of the members of your committee (exhibit 2, illustrating 9 screens). It will be observed that the screens are packed in some cases perfectly solid with dry mud and dirt so that it is impossible for any air to pass through them. The composition of the material seems to be chiefly dust, pipe scale and rust. In one case you will observe a chunk of coal about 58 in. square. Clearly, then, it is not desirable to do away with the screen in the drain cup, and the scum at the entrance of the triple is also a most important auxiliary in contributing methods for the best available brake service. But how many of our inspectors would miss this screen if triples were issued to them without the screen? A case has come to the attention of your committee where 20 triples were inadvertently issued at one shop, without any screens, and every one was put in service without the screen. With such carelessness and want of attention is it any wonder that brakes are sometimes reported as not working.

Let us return, however, to the consideration of the drain cup. We hope, through this exhibition of triple valve screens removed from triples not provided with drain cup screens, we have succeeded in showing how important a part a properly screened drain cup plays in the successful working of a quick-action air brake. It must be borne in mind, however, that everything eventually wears out on a railroad, and the Master Car Builder who allows the screens in his drain cups to run without any inspection or attention must not expect any better results than are obtained from those that are allowed to run without any screens. Those of us who examine into this will find that the netting rusts and cuts out and filth accumulates in quantities that is almost beyond belief. Exhibit 3 (illustrating) shows a collapsed condition into which screens get when they become gummed up and worn out. It also shows the fine condition the sponge gets into when by long service it is thoroughly mixed with rust, oil and dirt. All sponge should be removed at once from drain cup, not only from freight cars, but from passenger car drain cups.

Exhibit 4 shows two triple screens removed from triples that had drain cups originally fitted with horizontal screens without sponge, but the screens had become misplaced. Apparently the screens were too long and were bent when the piping was screwed up. They were in this bent and flattened condition when removed from the drain cups. Air and dirt passed by without going through the screen, the result being shown by the condition of the triple screen.

They are packed solid with dirt and are just as bad as those shown in exhibit 2. Exhibit 5 is a very interesting case: it shows a screen still in position, but which from some cause has collapsed and partly assumed an upward position and is rapidly getting coated over with rust and dirt. Exhibit 6 (illustrating) shows a method by which this collapsing of screens might be averted. It will be observed that this is accomplished by simply inserting a piece of coiled wire. The arrangement is not patented and any one may use it. Figure 7 shows the tank-drain cup which, as you know, is not fitted with the quick-action brake. Up to the present time we believe there has been no attempt on the part of any of the brake companies to use screens in tank-drain cups. The lower cavity is supposed to collect all passing dirt and water, and this is intended to be removed by blowing off through the small pet cock. In practice we believe it will be found that the opening to the pet cock soon stops up, the cavity fills with mud and dirt and the drip cup is then of practically no value. Exhibit 8 shows one of these cups as removed from a tank of an engine on the C., B. & Q. R. R. (illustrating). It will be observed that the cock is gone and the hole plugged with dirt and the cup well filled with dust and dirt. That this dirt will work its way into the triple must be evident from illustrations already cited.

To sum up we advise as follows:

First—Remove all sponge from drain cups.

Second—See that screens in drain cups and in triples are properly maintained and of proper mesh.

Third—Apply screens to all tank-drain cups.

G. W. RHODES,
E. B. WALL,
GEO. GIBBS,
A. S. VOGT,
E. A. WILLIAMS,
} Committee.

DISCUSSION OF REPORT OF COMMITTEE ON AIR BRAKE TESTS.

Mr. WAITT: I move that this very valuable report of the committee be received and printed in the proceedings, and that a copy of the report be furnished to each of the members as soon as can be done by the Secretary, and the committee continued.

(The motion was carried with the understanding that there should be included in the printed report illustrations of the defective screens, drain cups, dirt, etc., which were exhibited by the committee.)

Mr. BISSELL: I think that it is due to the Pennsylvania Railroad company as well as to this committee that we express to them by a hearty vote of thanks our appreciation of the great interest they have taken in develop ing these air break tests. The more we see of it the more we perceive how little we know about it. There is no one here to-day, outside of this committee, I suppose, who dreamed of the filth and the obstructions inside of the air brake. We have reason to be thankful that we have such men among us as Mr. Rhodes and some other men here who will go to the labor to demonstrate in a scientific way these grand truths. The motion was carried.

DISCUSSION OF REPORT ON STEEL CENTRE SILLS.

[This report was printed last week.—Editor.]

Mr. BARNES: I would like to say that what appears in this report is the unanimous opinion of the committee. Each of us had individual opinions which were not put in, because they were not unanimous. Little is said in the report about steel centre sills, because I can find no case where any one has ever built a car with a steel centre sill without a whole steel or iron underframe. Therefore we had to include the steel frame as a whole.

Since preparing the report I have been enabled to gather some statistics that bear upon the matter. I find that the total cost of maintenance due to wrecks is about 6 per cent., 3 per cent. of which is due to the loss of cars as a whole and the replacement of cars broken up. This leaves 3 per cent. only for the total cost of maintenance due to wrecks that applies to repairing wrecks. Therefore it is clear that while many have claimed that the main objection to steel underframes lies in the cost of repairing after wrecks, yet it is true that the cost of maintenance due to wrecks is so small that any substantial increase in durability due to steel would more than overbalance any cost that might result from the increase of repairs to steel centre sills in wrecks. In fact a very small saving in percentage of cost of total maintenance due to the use of steel sills would vastly overbalance any increased cost due to the difficulty of repairs after wrecks. The drawings are already described in the report, except one error. Figs. 14, 15 and 16 have the wrong title. They should be reversed, and 17, 18 and 19 be used instead.

It has been said that corner collisions are common, and that in case of the use of steel underframes there would be much difficulty in repairing the frames after such collisions; but, as far as steel centre sills are concerned, there would be no change in the cost of repairs, for centre sills are not affected by corner collisions, and this report refers more particularly to steel centre sills. The main point of difference in the committee has been on the question of riveted or bolted joints. I stand alone in favoring a riveted joint, as I firmly believe that no thin material should ever be joined without rivets—bolts so quickly break loose where the material is not of considerable thickness. In no class of engineering work that I am familiar with are bolts used for thin material, and this opinion is borne out by the report of the Truck committee given here to-day.

A special committee appointed at Wednesday's meeting to revise the charges for labor in the interchange rules presented a revised schedule of changes, which was approved. The Rules of Interchange, as amended, were then adopted as a whole.

The Committee on Subjects then reported as follows:

1. Brakebeams—as recommended by the Committee on Brake Beams for 1893.

2. Recommendations for standard location and ar-

rangement of safety chains for freight cars, and recommended practice for attachment of same.

3. Progress in heating methods for passenger equipment.

4. Progress in ventilation for passenger equipment.

5. Wheel and flange gauges.

6. Progress in advanced methods for lighting passenger trains.

7. What is being done and what should be done in maintaining air-brake apparatus on freight equipment.

8. Hand brakes and their maintenance on passenger equipment.

9. Compressed air and its application and use in connection with car shops.

10. Lubrication of cars and prevention of hot boxes.

A. M. WAITT,
R. E. MARSHALL,
S. A. CRONE.

The report was referred to the Executive Committee.

REPORT OF SPECIAL COMMITTEE ON LOCATION OF DUMMY COUPLINGS.

Your committee appointed to report on the advisability of submitting to letter ballot the change proposed in the standard location of dummy couplings for air brake hose is of the opinion that the location suggested, as shown on the blueprint submitted, is preferable to the present standard location. It is therefore recommended that the question be submitted to letter ballot, all details of construction being omitted from the drawing, and only the dimensions necessary to determine the location shown on the standard drawing which would be affected by the change.

R. E. MARSHALL,
A. M. WAITT,
S. HIGGINS.

REPORT OF COMMITTEE ON RESOLUTIONS.

The Committee on Resolutions, which had not prepared its report when the convention adjourned, later in the day handed to the Secretary the following report:

WHEREAS, Many courtesies have been extended to the members of the M. C. B. Association and their families and friends during the meeting at Lakewood,

Resolved, That thanks be extended to the N. Y., L. E. & W. Railroad for free transportation and excursions extended to the members and their families;

To Messrs. A. E. Mitchell and S. Higgins, of the motive power department of the N. Y., L. E. & W. Railroad, for their kindly interest and personal efforts toward the success of the convention and the comfort of the members.

To the N. Y. C. & H. R. R. R. Co., the Chautauqua Lake Railway company and Chautauqua Steamship company for transportation and excursion tendered; and be it further

Resolved, That our thanks be extended to Messrs. Sibley and Miller for courtesies.

To the Chautauqua Assembly for tendering the Association the privileges of its grounds.

To the *Railway Age and Northwestern Railroader* for its enterprise in publishing a daily paper with full reports of the proceedings of the convention.

To the proprietor of the new Kent House, Mr. Brady, the manager, Mr. Fox, and their able assistants for their politeness and kindly attention to the comfort of all.

E. M. ROBERTS,
WM. MCWOOD.

Mr. Rhodes offered the following resolution: That the present size of the M. C. B. annual report, namely, 6 in. by 9 in., be adopted as standard and be submitted to letter ballot. If manufacturers in their trade books would adopt this standard of 6 in. by 9 in., or for larger pamphlets some other dimensions, it would be a great convenience to the railroad men in preserving and keeping the circulars. As it is now they are all sizes. They do not fit the drawers and cabinets, and in many cases they get lost. The resolution was adopted.

Mr. SANDERSON: I would move that a committee be appointed to confer with the organization of trade supply men with a view to adopting some one or two standard sizes of trade catalogues to be used for all railroad supply purposes, and to look into the question of having a standard size for railway specifications. Carried.

The M. C. B. button used this year at Lakewood was adopted as the standard button.

OFFICERS.

The following officers were elected:

President, E. W. Grieves.

First Vice-President, J. S. Lentz.

Second Vice-President, S. A. Crone.

Third Vice-President, T. A. Bissell.

Treasurer, G. W. Demarest.

Executive Committee members for two years: R. C. Blackall, J. C. Barber, J. M. Wallis.

The President appointed Mr. G. W. Rhodes, Mr. R. P. C. Sanderson, and Mr. W. H. Lewis as the committee to look after standard size of catalogues and standard form of specifications.

The following localities were named for next year's meeting:

Saratoga, Old Point Comfort, Denver, Alexandria Bay, Montreal, Kansas City, St. Paul, St. Louis.

The convention then adjourned.

ON ROAD TESTS.

N. Y. C. & H. R. R., S. A. Crone; Chesapeake & Ohio, W. S. Morris; Chicago, Burlington & Quincy, G. W. Rhodes; Chicago, Burlington & Northern, W. H. Lewis; Fitchburg Railroad, J. W. Marden; Norfolk & Western, R. H. Soule, Chairman; Pittsburgh, Cincinnati, Chicago & St. Louis, A. M. Waitt; N. Y., L. E. & W., A. E. Mitchell; Chicago & Alton, Joseph Townsend; Pennsylvania Railroad, H. S. Hayward; Northern Pacific, J. C. Barber; Central Railroad of New Jersey, H. L. Hoffecker.

In the case of the P., C., C. & St. L., Mr. S. B. Bush being on the Committee for Laboratory Tests, Mr. A. M. Waitt of the L. S. & M. S. was appointed in his stead.

ON LABORATORY TESTS.

S. B. Bush, Chariman; D. C. Barnes, Jno. W. Cloud.

Mr. John W. Cloud was unanimously elected Secretary of the Association.

No reports were presented by the following committee, which were appointed last year: Truck Pedestals and Safety Chains, Steam Heating of Passenger Cars.

EXHIBITS.

To the list of exhibits at the conventions, which appeared in our last issue, the following should be added:

Drexel Railway Supply Co., Chicago, sample Northern Pacific stock car, 36 feet in length; weight 29,850 lbs.; capacity 50,000 lbs.; equipped with Drexel (Barber) truck; Drexel coupler; Drexel box lid; Drexel brakeshoe keys; Westinghouse air brake; National hollow brakebeam; Barr contracting chill wheels; Q. & C. stock car door and Cleveland wrought iron turn-buckles. This car was built at Northern Pacific shops in April for exhibition at this convention. The Drexel company also shows models of the Barr vestibule, the Drexel passenger coupler, and other specialties.

American Coupler Co., Chicago, show a full-sized drawbar.

Pratt & Letchworth, Buffalo, N. Y., exhibit the Pooley coupler and the O. K. brake adjuster.

La Burt Automatic Electric Block Signal System and Coupler Co., New York, exhibit a full-sized drawbar.

Buckeye Automatic Car Coupler Co., Columbus, blueprints of the Buckeye Coupler and samples of good malleable iron.

Clarence Whitman & Co., New York, exhibit samples of "Pantasote" leather, for car seats, car curtains, etc.

Automatic Pipe Coupling Co., New York, exhibits pipe couplings for automatically coupling air, steam and signal pipes.

Keystone Car Door & Supply Co., Williamsport, Pa., flush car door.

Bushnell Manufacturing Company, Easton, Pa., car seats.

J. L. Wagner, Indianapolis, Ind., car door.

Moran Flexible Steam Joint Co., Louisville, Ky., model of Moran Joint for air-brake and steam heating pipes.

Barbey & Hickmott, Boston, Mass., steam specialties and the standard steam trap, for use on passenger cars heated by steam, also for stationary plants.

Capt. J. M. Elliot, Gadsden, Ala., M. C. B. coupler.

Weeks, Bush & Co., Kingston, N. Y., car coupler.

James Timms, Columbus, O., the American Dust Guard.

Slaughter & Horton, New York, M. C. B. car coupler.

Falls Hollow Stay Bolt Co., Cuyahoga Falls, O., samples of Hollow staybolt iron for locomotive boilers.

La Burt Automatic Electric Block Signal System and Car Coupler Co., N. Y., M. C. B. car coupler.

Wm. S. Soule & Co., Boston, rawhide lined dust guard.

Jenkins Bros., New York, valves and packings

George P. Wilson, Philadelphia, the Kimball improved bushing pull and Butler sand dryer.

Chicago Railway Equipment Co., blueprints of National Hollow brakebeam.

Hayden & Derby Mfg. Co., N. Y., Metropolitan double tube locomotive injector.

Hendrick Mfg. Co., Carbondale, Pa., perforated metal spark arrester and other samples of perforated metal.

William Yerdon, Fort Plain, N. Y., Yerdon's improved double hose band and adjuster.

Capitol Mfg Co., Chicago, Adam's automatic bolt threading and nut-tapping machine.

W. S. Bales, Des Moines, Ia., Bales' automatic car coupler.

Tyler Tube & Pipe Co., Washington, Pa., samples of knobbed charcoal iron boiler tubes and odd shapes hammered from same.

Solid Steel Company, Alliance, O., handsome World's Fair announcement.

Detroit Lubricator Co., Detroit, Mich., invitations to inspect World's Fair exhibit.

Coles Flue Expander and Beader Co., Hartford, Conn., flue expander and beader machine.

U. S. Metallic Packing Co., Philadelphia, new catalogue.

Journal Oil Co., Bradford, Pa., samples of Haggerty's cooling compound.

M. C. Hammett, Troy, N. Y., Corey's forced feed locomotive lubricator.

Morton Safety Heating Co., Baltimore, Md., system of car heating by steam in earthenware tubes.

Tight Joint Co., New York., Folly's patent tees, couplings and return bends.

National Machinery Co, Tiffin, O., showed the National bolt heading and nut-tapping machine, fine collection of forgings made on their upsetting machines; also distributed two special catalogues published especially for the conventions.

Loughbridge Brake & Car Co., Philadelphia, showed a model of the Loughbridge brake slack adjuster.

Holmes Agnew, New York, a model of the Parmlee automatic sash lock for car windows.

Eureka Coupler & Buffer Co., Minneapolis, a handsome exhibit of the Eureka coupler.

United States Bronze Co., Cleveland, exhibited samples of journal bearings with motor metal linings.

Simplex Car Coupler Co., Chicago, showed a pair of full-sized M. C. B. drawbars, with attachment to prevent couplers falling on track.

The Hinckley Brake Co., Trenton, N. J., showed a most interesting exhibit of automatic brake slack adjusters, of full size, as applied to a car.

Slaughter & Horton, New York, showed the Pero coupler.

The Crane Air Brake Apparatus.

The Crane Co., of Chicago, celebrated builders of elevators, have long been occupied in the development of a complete system of air brake apparatus, and have for some time been selling special parts for repairs of brake apparatus of other makes. They now have their own system developed and ready to put on the market, and exhibit at the World's Fair 100 sets of air brakes complete, piped in series, and operative, for tests and demonstration. From the catalogue just issued we take the engravings and description which follow, showing the various parts of the apparatus.

AIR PUMP.

The 8-in. air pump is shown in two views, figs. 1 and 2. These hardly require explanation. In the engraving 3 is the steam cylinder and 5 the air cylinder; 7 is the steam piston and rod and 8 the air piston. The reversing valve and valve rod are shown by 13 and 14, and the main piston valve at 16; 23 shows the air valve, 39 the drain cock and 40 the air strainer. The valve motion is all in the top head, and consists of a slide valve with a piston on each end and a small auxiliary valve operated by a reversing rod. The movement of the auxiliary valve admits live steam alternately to the outside of the two pistons, and as the live steam is admitted to one end the opposite chamber is put in communication with the exhaust. The slide valve, auxiliary valve seat and both piston heads are all in one piece, making a very simple construction. This pump is furnished with either a 9-in. or a 13-in. stroke.

THE ENGINEER'S VALVE.

The engineer's brake valve and equalizing valve is shown in four views. Fig. 3 is a vertical cross-section through the centres of the emergency and graduating valves. Fig. 4 is a horizontal cross-section through the centre of the main reservoir governor valve, part of the casing being shown entire. Fig. 5 is a side view of the valve as a whole, and fig. 6 a view of the slide valve seat.

In figs. 3 and 4, 8 is the operating handle and 9 the spring and 11 the slide valve crank and shaft, and 13 is the slide valve; 17 is the graduating piston and 16 the graduating spring. The excess pressure valve is shown at 21. Figs. 27, 29 and 31 show respectively the regulating spring, diaphragm valve and diaphragm; 34, 35 and 37 are the emergency stem, emergency valve seat and emergency valve spring.

The main functions of the valve are performed by the slide valve 15 operated by the bell crank lever 11. The handle is placed vertical for economy of space and the slide valve moves up and down on its seat. The emergency valve, 36, is separated from the main slide valve and so arranged as to be inoperative except when the handle is thrown beyond the service notch, and there is considerable resistance to the movement of the handle beyond that notch. It is supposed that by this arrangement it will not be used as frequently as the emergency feature of the Westinghouse. The valve handle presses downward upon the stem, 34, to unseat this emergency valve.

The graduating valve, 17, is in the form of a piston and stem, the piston having no pressure on either side except during graduation. When it is desired to set the brakes for a service stop the handle is moved to the proper notch, then a small quantity of air from the train pipe acting under the piston, 17, raises the valve from its seat and allows train-pipe pressure to escape through the exhaust. When the handle of the valve is returned to the on-lap position the valve, 17, gradually closes as the air from underneath escapes through a small hole in the piston. A small reservoir is connected to the cavity underneath piston 17, to insure a more gradual closing.

Another novel feature of the engineers' valve is the arrangement for governor connection, which is so designed that while the handle is in the running position air can pass to the governor pipe only after raising the diaphragm valve, 29, as shown in fig. 4, against the resistance of the spring, 27, which may be set to any desired pressure. In the release position the air passes directly from the train pipe to the governor pipe, and the governor being set at 70 lbs. prevents an excessive pressure accumulating in the train pipe during release. The passage of air from the main drum to the train pipe in the running position of the handle is resisted by the check valve, 21, and spring, 20.

The special claims of superiority are:

The form of the valve—a slide valve being easier to keep tight than a rotary valve or plug.

The emergency valve will not be used when not needed.

A graduating valve with which the engineer has immediate control of the train-pipe exhaust.

An improved system of governor connection by which it is impossible to accumulate an excessive pressure in the train pipe if the handle is left in the release position; while at the same time, with the handle in the running position the use of air from the main drum for sanding apparatus, bell ringers, etc., will not reduce the excess pressure.

All the pipe connections are made to the main body of the valve and it is unnecessary to disturb any of them to get at the working parts or face of the seat of the slide valve.

THE PUMP GOVERNOR.

The pump governor is shown in fig. 7, in which 2 is the steam valve body, 3 the governor piston chamber, 5 the governor piston, 9 the steam piston, 14, 16 and 17 a diaphragm stem and diaphragm valve. The throttle valve and piston, 9, is put in from below in such a manner that it may be removed by simply unscrewing the cap which is shown. Steam enters the valve between the seat and the piston, 9, and because of the larger area of the piston, raises the valve from its seat so as to open the passage and stop the pump. The leakage through the small hole in the piston passes through the port in the side of the casing and out by the seat of the valve, 5, which is raised until the required pressure has been accumulated in the train pipe. Air enters from the train pipe at 21, and bearing against the diaphragm, 16, raises valve, 17, from its seat, pushing the piston and valve, 5, down until it seats and stops the escape of steam from the under side of the piston, the steam incidentally accumulating and sufficient pressure being supplied to seat the throttle valve and cut off the supply to the pump.

THE TRIPLE VALVE.

The quick-acting triple valve is shown in fig. 8. It consists of a main body, 2, containing a piston and slide valve for graduation, and a piston and rubber-seated valve for controlling the quick action.

The piston, 4, has a slide valve, 3, attached to the stem, which, by means of a cavity on its under side, opens the exhaust from the cylinder when the valve is in the position shown. Another slide valve, 7, is attached to the piston stem a little in advance of the slide valve, 3, and controls an opening from the auxiliary reservoir into the cylinder. This small slide valve is the graduating valve proper, and is attached to the stem without lost motion. The slide valve, 3, has a slight range of lost motion on the stem.

The emergency valve consists of a cup piston, 8, and stem, 10, with an emergency valve, 11, seating on the bushing, 9. The non-returning check valve, 15, is for the purpose of retaining the air in the cylinder in case the train-pipe pressure is reduced below that in the cylinder.

The operation of the valve is as follows: Air enters through the strainer, 16, passes through the small by-pass port in the emergency piston bushing to the cavity above the piston, and thus through the passage shown to the back side of the main piston, 4, and through a feed groove around the main piston into the auxiliary reservoir, which is directly connected to the slide valve chamber.

For service application, a reduction is made in the train pipe sufficient to cause piston 4 to move backward, closing first the feed groove, then the exhaust port under the slide valve, 3, and then uncovering the port under the small slide valve so as to allow auxiliary reservoir pressure to expand into the cylinder. When the pressure in the auxiliary reservoir has become slightly less than the pressure remaining in the train pipe, the piston, 4, moves backward until the shoulder on its stem strikes the slide valve, 3, taking up the lost motion between the slide valve and the stem. This brings the valve, 7, back sufficiently far to cover the opening from the auxiliary reservoir into the cylinder.

To increase the braking power, another reduction is made in the train pipe, causing the valve, 7, to re-open the port to the cylinder until the pressure in the reservoir is reduced again below that in the train pipe, when the piston, 4, and valve, 7, move backward as before. This operation may be repeated as often as necessary, until the desired degree of pressure is obtained on the brake, or the auxiliary reservoir pressure has equalized with the cylinder pressure.

To release, pressure in the train pipe being restored, the air, passing through the by-pass in the emergency piston bushing, presses against the back side of the piston, 4, forcing it back to the position shown in the engraving, closing communication between the reservoir and cylinder, opening the exhaust port from the cylinder to the atmosphere, and re-opening the feed groove around the main piston.

In service applications the emergency feature of the valve remains inoperative.

To make an emergency stop, heavy reduction is made in the train pipe, causing the pressure in the cavity above the piston, 8, to force the piston downward. This unseats the poppet valve, 21, opening an exhaust from the under side of the piston to the cylinder by means of the passage drilled through the centre of the valve, 10. After the valve, 21, opens, the port from the train pipe to the under side of the piston, 8, is closed by the downward movement of the piston. This shuts off communication from the train pipe to the cavity under the piston at the moment that the pressure in the cavity is exhausted into the cylinder; the resistance on the under side of the piston being removed, it continues its downward movement until the large circular port cored around the bushing (shown in dotted lines) is entirely uncovered, and the emergency valve, 10, pulled away from its seat, thus allowing the air to pass from the train pipe through this large port and the central opening in the bushing, 9, to the cylinder, the rush of air lifting the check valve, 15, from its seat.

As the pressure equalizes between the train pipe and the cylinder, the leakages around the emergency piston, 8, allows the exhaust cavity under the emergency piston to fill, when the spring, 22, forces the emergency valve back to its seat, closing the large port, seating the valve, 21, and opening the port which establishes communication between the train pipe and the under side of the piston.

The cap to which the drain cup, 13, is attached is made large enough to permit of the removal of the emergency valve and piston when it is unscrewed. The advantage of this will be readily seen when it is noted that the emergency valve can be removed for cleaning or repairs without disturbing the gasket pipe connection to the train pipe.

AIR-SAVING APPARATUS.

The arrangement of the air-saving apparatus is shown in fig. 9. This device, shown in connection with the pump, main reservoir and engineers' valve, is for the purpose of preventing the total loss of the air pressure that is exhausted from the train pipe in making service stops. A small drum, 1, is provided for the purpose of catching the air as it is exhausted from the engineers' valve. Connection is made from this drum to the suction ports of the pump, so that it will be supplied with air under pressure while there is any exhaust from the train pipe. When this exhaust ceases, and the pressure remaining in the small reservoir has all been pumped out, the pump receives its supply from the atmosphere through the swing check valve, 2.

A safety valve, 3, is provided to prevent the accumulation of pressure in excess of a predetermined limit, say, 15 lbs., so that as long as there remains more than fifteen pounds in the train pipe there will be no interference with the graduation action of the brakes, even if the pump should stop entirely.

We are informed that with this device in service the capacity of the pump is doubled while the brakes are being applied, and until the pressure in the small reservoir is nearly exhausted. This insures not only a greater ability to recharge after a release, but also a more certain and prompt release because of the higher excess pressure, which is accumulated just at the moment that it is most needed.

The fact that the air supplied to the pump will be cleaner, because in its passage through the small reservoir it is freed from considerable of the dust and moisture, is another valuable feature. This apparatus can be readily attached to any pump now in use.

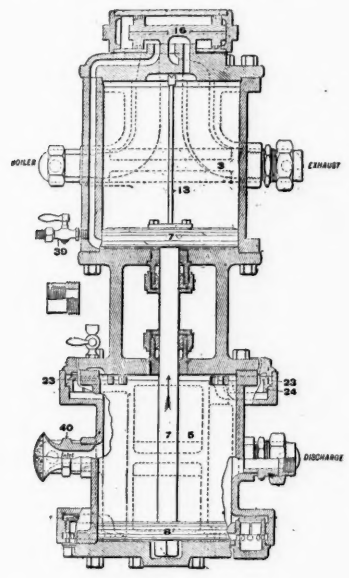


Fig. 1.

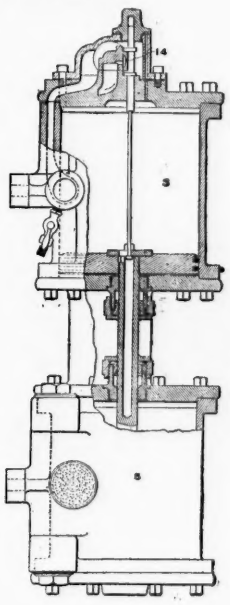


Fig. 2.

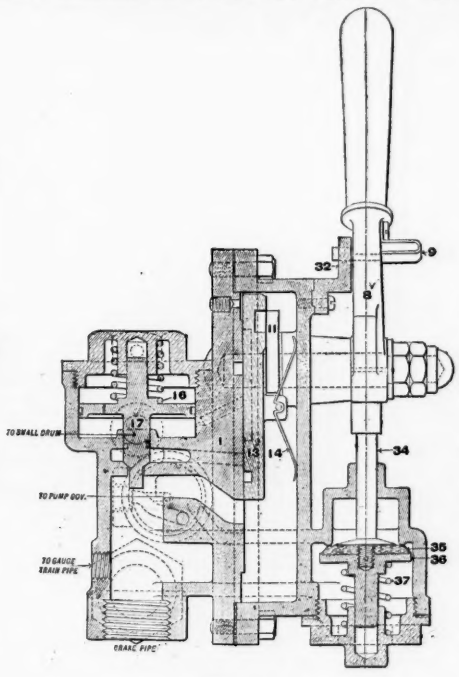


Fig. 3.

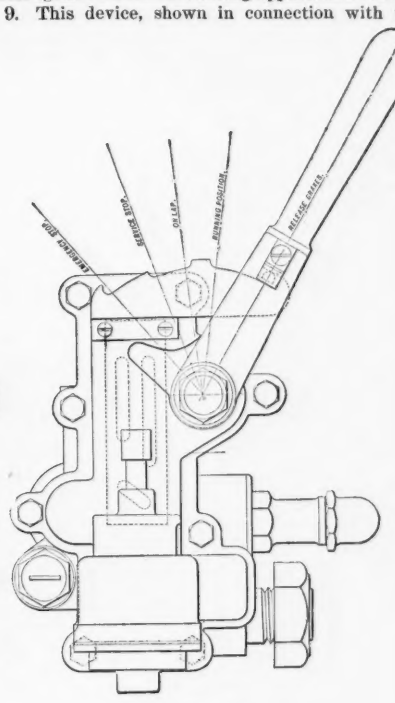


Fig. 5.

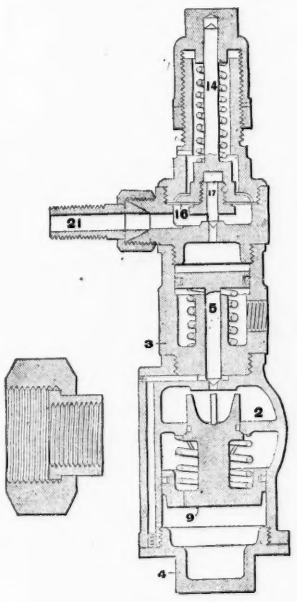


Fig. 7.

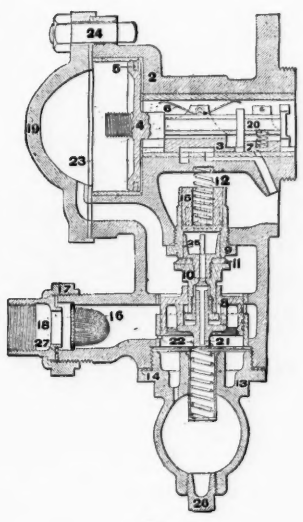


Fig. 8.

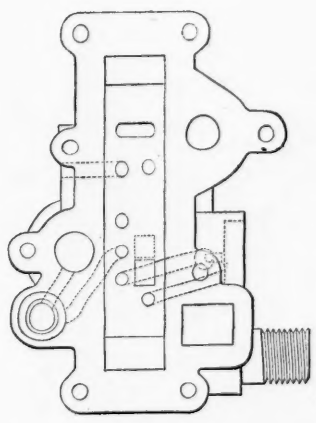


Fig. 6.

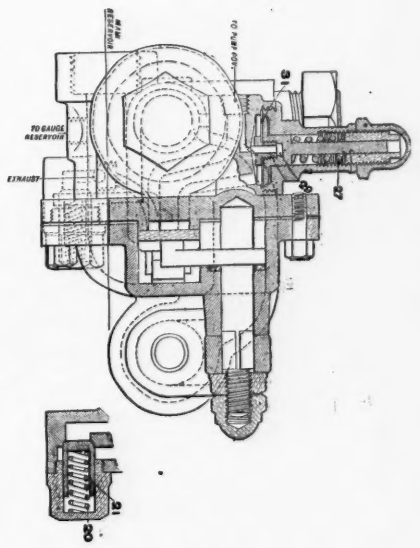


Fig. 4.

PARTS OF THE CRANE AUTOMATIC AIR BRAKE.

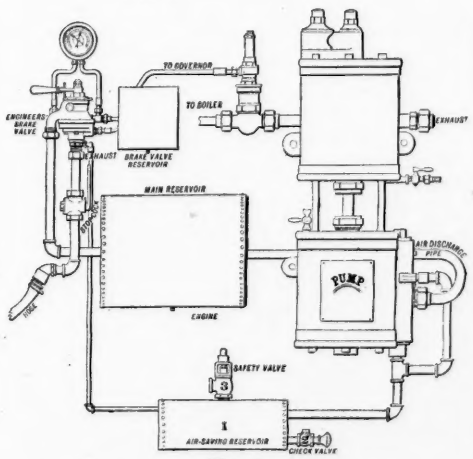


Fig. 9.

Simons' Drop Doors for Coal and Coke Cars.

The Pittsburgh & Lake Erie Railroad has most of its cars adapted for coal and coke and there has been much inconvenience caused by shippers cutting the floors to let the coke and coal out of the bottom, thus avoiding the expense of shoveling. The Assistant Master Car Builder, Mr. James E. Simons, has devised a scheme for drop doors to be used without a hopper bottom, that is shown in figs. 1 and 2. It is seen that this plan is adapted for the ordinary gondola car. The arrangement of parts and the operation are about as follows.

On each side of the needle beams there are provided holes through the bottom of the car which are closed by swinging doors. In the illustrations one of the doors is shown open and the other shut. The doors are hinged to a transverse beam and swing downward and toward the end of the car. They are hoisted into position by means of a chain passing over a chain wheel and wound up on a drum that is mounted on a shaft that extends to the side of the car. The door is held in position by an automatic catch that is operated by a counterbalanced weight on one end of the bell crank as shown in fig. 1. The locking and unlocking mechanism is operated from the side of the car by means of the crank shaft shown in fig. 2.

One advantage claimed for this arrangement is that the door is either full open or full shut; it cannot be left part way open and in a position to spill the contents of the car along the track. Some cars have been built with this arrangement and have been found to be very satisfactory in service. The drawings do not show the proportions of the details, but merely illustrate the method of construction and operation.

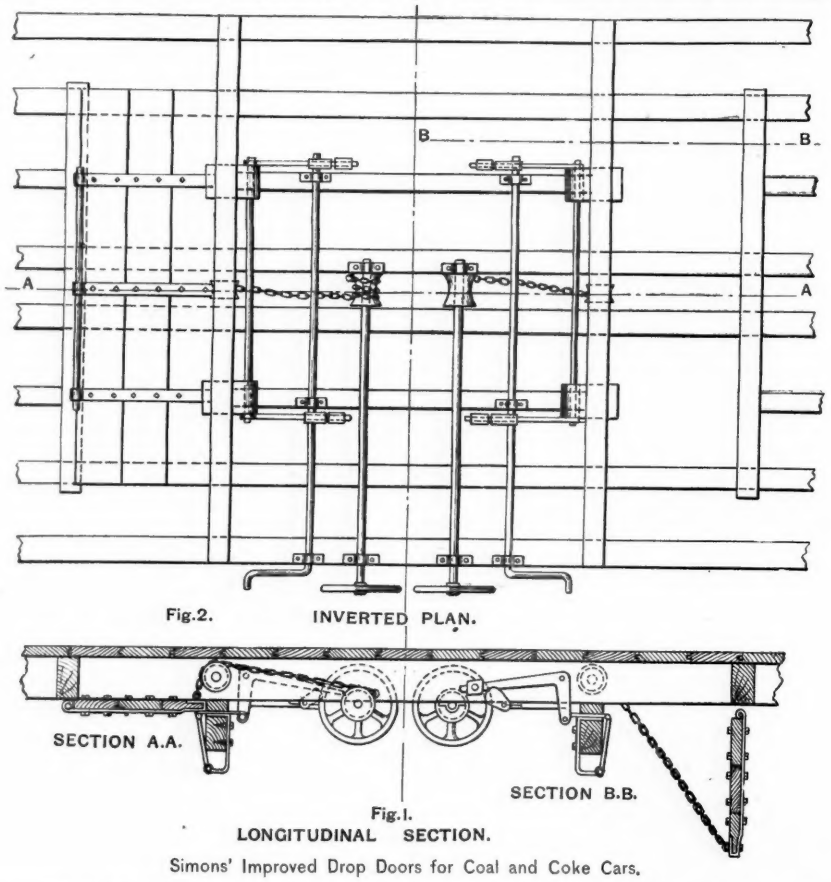


Fig.2. INVERTED PLAN.

Fig.1. LONGITUDINAL SECTION.

Simons' Improved Drop Doors for Coal and Coke Cars.

High Speed Locomotives Compared.

Fresh interest has been aroused in the fast running of trains that has been done during the last few years by different railroads of both America and Europe; and in order that the important features of the locomotives hauling such fast trains may be compared the more readily, some of the more important data relating to them have been tabulated below as a continuation of the tables of notable fast runs of passenger trains for long and short distances given in the *Railroad Gazette* of June 2, 1893. All but one of these engines were designed especially for the fast service in which they are used. The West Shore Class "B" locomotive was not designed for what are now considered high speeds, but it has a long distance record of 422.6 miles in 8 hours 17 minutes, actual running time, which shows an average speed of 51 miles an hour.

The "Greater Britain" was designed by Mr. F. W. Webb to haul the heavy and fast passenger traffic over the West Coast route to Scotland between London and Carlisle. It has two pairs of driving wheels, the back pair driven by two high pressure cylinders outside of the frames, and the forward pair driven by a single low pressure cylinder placed between the frames. The valves of the high pressure cylinder are operated by eccentrics and links in the ordinary way, and the valve to the low pressure cylinder is operated by Mr. Webb's single eccentric motion, used on all the recent London & North-Western compounds. During tests of this engine soon after it was built, it made a run of 158 miles at an average speed of 42.88 miles an hour with a train weighing 366 tons. The water evaporation on this test was at the rate of 10.96 lbs. for each pound of coal.

As is generally understood, the Class "N" engine (No. 999) of the New York Central & Hudson River, and the Class 17-A of the Lake Shore & Michigan Southern, were designed to haul the "Exposition Flyer" between New York and Buffalo, and Buffalo and Chicago, respectively. The Class "N" locomotive was illustrated in the *Railroad Gazette* of April 28, 1893, and the Class 17-A in the issue of June 2, 1893.

The locomotives of the Northeastern Railway were designed by Mr. T. W. Worsdell for working the fast Scottish traffic on the East Coast route, a service which requires speeds not unfrequently exceeding 60 miles an hour. The engines handle some of the alternate expresses in turn, the average composition of the trains being 13 six-wheeled carriages; but they frequently have to take 16 to 18 vehicles, heavy loads with which they make the time in favorable weather. The engines are compounded on the Worsdell and Von Borries system, two cylinder type.

The locomotives of the Central Railroad of New Jersey, of the same class as No. 385, and those of the Philadelphia & Reading, of the same class as No. 618, are remarkable as the first really fast eight-wheel compounds built in America. They are running in difficult service between New York and Philadelphia, hauling from four to nine coaches and making about nine stops and several slackings in the distance of 90 miles, and with a schedule time of two and one-quarter hours.

By comparing this table with the tables in the *Railroad Gazette* of June 2 giving the notable fast runs of passenger trains for long and short distances, it will be found that the single expansion locomotive holds the record for fast speed for both long and short distances.

SOME OF THE DIMENSIONS OF CERTAIN HIGH SPEED LOCOMOTIVES.

	Cylinders, Diameter and Stroke.	Driving wheels, diam. inches.	Weight on driv. ers. working order, lbs.	Weight, total, lbs.	Wheel base. Driving, ft. and in.	Wheel base. Total, ft. and in.	Tubes. Number.	Tubes. Diameter, inches.	Tubes. Length, inches.	Heating surface, sq. ft. Firebox.	Heating surface, sq. ft. Tubes.	Heating surface, sq. ft. Total.	Grate surface, sq. ft.	Heating surface divided by Grate surface.	Boiler pressure, lbs. per sq. in.	Max. travel, inches.	Valve. Outside lap, inches.	Valve. Inside lap, inches.	Lead in full stroke, in.	Steam ports, size, inches.	Exhaust ports, size, inches.	Journals, driving, diam. and length, inches.	Boiler, diam., smallest ring, inches.	Firebox. Length, inches.	Firebox. Width, inches.	
West Shore, class B	18 × 24	68	62,500	94,500	...	...	188	2	131	128.00	1,084.00	1,212.00	16.86	71.8	140	5¼	1⅜	0	1/16	16 × 10	16 × 3¼	...	...	...	...	Single expansion.
Greater Britain, L. & N. W	15 and 30×24	85	74,000	125,000	8-3	23-8	156	2⅛	102½	159.70	1,420.30	1,580.00	20.50	77.4	175	5½	1⅜	0	1/16	8 × 3¾	8 × 5¼	7¾ × 13½	58⅛	108⅜	40⅝	Webb compound.
N. Y. C. & H. R., class N	19 × 24	86	81,000	124,000	8-6	23-11	268	2	141	232.92	1,697.45	1,930.37	30.7	62.9	190	5¾	1	H. P. ¼ neg.; L. P. ⅛ neg	1/16	H. P. 11¾ × 3½; L. P. 17 × 3½	H. P. 11¾ × 3½; L. P. 17 × 3½	9 × ...	51	58⅛	40⅝	Single expansion.
North Eastern (Worsdell) express type	18 and 28×24	85¼	43,200	102,500	0	21-11	203	1¾	131⅛	110.00	1,026.12	1,136.12	17.23	65.9	175	5¼	1¼	0	1/16	19⅛ × 5½	19⅛ × 5½	7 × 11	51	63⅝	39	Worsdell, von Borries two-cylinder compound.
C. R. of N. J., No. 385	13 and 22×24	78	88,400	123,800	7-6	22-3½	250	2	130	166.00	1,530.00	1,696.00	38.50	44.0	180	5⅝	1⅝ and ⅜	⅛ and ⅜	1/16	21 × 10	21 × 4½	8 × 12	58	131⅛	42¼	Baldwin compound.
P. & R., No. 618	13 and 22×24	78	83,000	126,000	6-10	23-4	324	1⅛	120	173.00*	1,261.75	1,434.75	76.00	18.88	175	5⅝	1⅝ and ⅜	⅛ and ⅜	1/16	21 × 10	21 × 4½	8½ × 12½	57½	111	96⅜	Baldwin compound.
L. S. & M. S., Class 17-A	17 × 24	72	65,100	104,600	9-0	23-9	200	2	141	155.00	1,238.00	1,393.00	23.24	60.80	180	6⅛	1	⅛ neg.	.....	19 × 3	19 × 3	7½ × 9	52	78	34	Single expansion.
P. & R., class D, 44-11	21 × 22	68½	72,464	107,184	7-0	21-1	324	1⅛	110¼	205.00	1,158.00	1,363.00	76.00	17.94	160	7	1¼	.....	.....	.....	.....	8½ × 12½	57½	114	96⅜	Single expansion.

*In firebox and combustion chamber.

Car Accountants' Convention.

The Eighteenth Annual Convention of the International Car Accountants' Association was held at Indianapolis, Ind., on June 19 and 20. In point of attendance and interest manifested in the proceedings, it was a success. The printed programme formulated by the Committee on Discussion was carried out as heretofore printed in the *Railroad Gazette*. The President and Vice-President were both absent, and the meeting was called to order by Mr. S. H. Church, of the Pennsylvania lines west of Pittsburgh, who was also chairman of the Executive Committee. About 100 members were present, and many of them were accompanied by their wives.

Mayor Sullivan, of Indianapolis, made a happy address of welcome, which was replied to by Mr. Church, who returned thanks for the cordiality and sincerity of the city's welcome. Among other things Mr. Church said: "In handling cars we trust a great deal to personal character. In other positions of trust personal character is re-enforced with bonds of high figures, yet, when I tell you that we pay and receive from each other each year, exchanging freight cars, more than one hundred millions of dollars, which is received entirely upon the personal certification of the gentlemen here to-day without any bond whatever, you will see that high character has something to do with railroad work, after all."

The reports of the Treasurer and Executive Committee which were received and approved showed that the affairs of the Association were in a prosperous condition. Several new members were elected. The election of officers for the ensuing year resulted as follows: President, S. H. Church, Pennsylvania company; Vice-

President, H. G. Sleight, Vandalia line; Secretary, S. P. Sechrist, New York; Treasurer, M. C. Trout, Toledo & Ohio Central; Executive Committee, C. P. Chesebro, Wabash; J. R. Cavanaugh, C., C., C., & St. L.; W. W. Wheatley, West Shore.

The Committee on Discussion, through its Chairman, Mr. W. W. Wheatly, reported that it had held several meetings during the year, and had been successful in promoting discussion on several pertinent topics, the papers and replies received having been printed and distributed to the members prior to the annual meeting. One of the subjects discussed was "A uniform system of home routing cars" by dividing the country into districts, such districts being numbered and divided by state lines or certain arbitrary boundaries." The committee did not indorse this plan, but merely suggested it for discussion. In the replies received the prevailing opinion seemed to be that the plan of districting the country would be very difficult of application owing to the large number of roads which would pass through several districts.

The other topics treated in the preliminary pamphlet were "Office methods," "Junction cards" and "Rules to prevent the misuse and diversion of freight cars." The opinions on the latter subject were almost unanimous in the view that the rules recently adopted by the American Railway Association, while their intent is good, are really not fitted to accomplish the object for which they were intended. The language of the rules, in many places, is ambiguous, and will admit of practices which it was the intention to avoid. The rules, to be effective, should be again revised.

The Committee on Constitution and Bylaws, through its Chairman, Mr. E. M. Horton, recommended certain necessary changes with the view of improving the organization of the Association for business purposes. This committee's report, however, did not provide for enlarging the number of standing business committees and expanding the scope of their work; neither did it provide for continuity of service in the membership of the committees. It has been the custom in the Association to dissolve its committees each year, and appoint new members for the ensuing year. Mr. Wheatly, of the West Shore, offered several amendments, which covered the points in question. He suggested the appointment of a committee on car service of seven members, and a committee on office methods and accounting of five members, which were to be the two principal standing committees, and the members of which were to have terms of office for one, two and three years. The scope of the duties of the proposed committees was made broad enough to cover almost the entire field of car service and car accounting. It was to be expected that, as the Association had only one standing business committee (the Discussion Committee) and only one special business committee (the Per Diem Committee), the excellent reorganization proposed by Mr. Wheatly would be adopted in full or in some modified form. It transpired however, that several members objected strongly to every change which was proposed, the only reason given being that the organization which they had worked under for 18 years was good enough for them. Much to the regret of the more progressive element in the Association, the best and most important of the amendments were laid on the table where they will slumber until some future time.

The report of the per diem committee was read by its Chairman, Mr. James Osborne, of the Canadian Pacific. The car service committee of the American Railway Association has promised that the agitation for the per diem system would be kept up. The per diem committee repeated its recommendation of last year, for an interchange rate of one cent a car a day, in addition to the present mileage rate, with the exception that no per diem would be charged upon cars received and delivered within 48 hours. This exception was inserted evidently to promote efficiency in handling cars. The proposed plan is nothing more than an experimental basis, to provide the means of obtaining information and statistics concerning car movements. The report of the committee was received and approved, and the committee continued for the ensuing year.

An interesting paper was read by Mr. S. H. Church, of the Pennsylvania Company, upon "The Limited Pooling of Freight Equipment." Mr. Church's plan had special reference to the pooling of box cars. Speaking of the subject of car supply, he said: "An indispensable condition on a road having a large traffic is a free supply of freight cars. The general rule on this subject is that each road shall use its own cars in any direction, but shall return foreign cars only in the direction of home. An evil result of this rule is that it brings into the question of car supply the element of selection. The question is not how many cars have we at each station, but how many of the cars that are at each station may we use for our business? A small proportion of these cars is available for the day's traffic, while a large percentage of the cars on hand must be loaded in specific directions or hauled empty in order to observe the rule. Mr. Church holds that an indispensable adjunct of the proposed pooling of box cars is the application of a per-diem rate, to prevent piracy. The removal of all restrictions in the use of box cars would permit them to be loaded either east, west, north or south, while the per-diem charge would force their prompt movement until they finally reach the home road, which is the only ground upon which they can stand without being subject to a daily charge. Mr. Church's paper showed careful study of his subject, and was well received.

A paper was read by Mr. Frank E. Haff, of the Long Island road, upon the subject: "The Car Accountant—A Misnomer; His Ultimate Elevation." Mr. Haff argued with much force that the proper sphere of the car-service officer was not merely to keep the records of car movements, or to become an expert bookkeeper of mileage accounts, but that he should have the power to distribute and control the movements of cars. Upon his shoulders should be placed the sole responsibility for car performance and car supply. He should be clothed with the necessary power and authority to handle his legitimate work under the sole direction of the General Superintendent. This being done, he argued that many of the evils prevalent under the present faulty system would disappear, because vesting him with the *power* to solve them is all that is necessary. The *remedy* he already knows, the *power* to apply the remedy alone is lacking. The officer controlling the performance and supply of cars belongs in the transportation department, not the accounting department. There is great significance in a name. A name is *not* a name in the true sense of the term unless it stands for something. This officer's duties requiring him to be familiar with many details of the transportation department, his title should be commensurate with the importance of his position. He should be the *superintendent* of car service, and his administration should be characterized by thoroughly honest dealing. Unless he is clothed with the power and authority to order the prompt movement of foreign cars homeward, or to put a stop to wholesale diversions of foreign equipment, honesty of intention counts for little or nothing. Under the present imperfect system, conscience cuts but a very small and dilapidated figure. Mr. Haff's paper also dealt with the question of extending the application of demurrage rules to all local stations, and placing their operation in charge of the superintendent of car service.

Mr. F. L. Hutchins, Agent of the Boston & Maine, addressed the Convention upon the subject of "Home routing of cars without the aid of tags or junction cards." It would be impossible in this limited space to give more than a brief outline of his plan, the details of which he explained at length to the Convention. He proposes to substitute an envelope or pocket to serve the double purpose of carrying the waybills, and of making a record over which the car passes to its destination. This envelope has suitable lettering on the outside and inside of the cover so that it may be used as a running slip if desired. Upon arrival at destination the agent can see at a glance from the junction movements stamped on the envelope the full home route of the car. The car may be returned by the route it came, or it may be loaded home by any other route, or it may be loaded to any of the intermediate roads over which it passed from point of shipment to destination. The home route folder or envelope should, however, always accompany it until its return to the home road. There is a great apparent advantage in having the home route always with every car, no matter what movements it may make or where it may be. A long and interesting discussion followed the reading of this paper, and there was much diversity of opinion as to the practicability of the proposed plan. There was substantial unanimity that it was theoretically good, but its actual value could only be found by giving it a trial and counting the cost. Mr. Hutchins' paper, with a report of the discussion upon it, was referred to a committee, for the purpose of taking a consensus of opinion. This committee will report at the next meeting of the Association.

A short and pithy paper was submitted by Mr. A. D. Penfold, General Auditor of the Merchants' Despatch Transportation Co., upon the subject of "Unnecessary Car Tracing."

Old Point Comfort was selected as the next place of meeting, and the third Tuesday in June, 1894, is the time.

Some Exhibits at the World's Fair.

WHEELS.

We have already noted in part the exhibit of wheels and axles at the World's Fair (see *Railroad Gazette*, May 26, 1893), and this article makes the report complete with the exception of the Krupp exhibit to be given later. Nearly all the wheels are in the southeast corner of the annex to the Transportation Building, and while not particularly attractive to a layman they will be a source of considerable information to railroad men.

The *Allen Paper Car Wheel Company*, of Chicago, has on exhibition their paper wheel for coaches; the plate wheels range from 26 to 42 in. in diameter. There are also hollow spoke wheels, cast iron centres with steel tires for coach and engine trucks. It is reported that there is quite a tendency to use spoked wheels for passenger equipment. The finished paper centre is shown and the method of bolting plates and holding the tire. A paper wheel 46 in. in diameter with a record of 788,324 miles and a 33-in. paper wheel with a record of 810,834 miles are in the exhibit.

The feature of the exhibit made by the *Lehigh Car Wheel & Axle Company* is cast iron centres with steel tires. Cast iron is the cheapest material that can be used in centres of wheels, and when the cost of retaining rings and fastenings is dispensed with these wheels become reasonably cheap. The method of making them is to leave a place in the mold for the tire, and just before pouring the centre to put in the tire while at a red heat. When the metal is poured the two are welded together so completely that it is possible to wear the tire very thin, ⅜ in. or less, without danger of its breaking. Of the thousands of these wheels in use since 1884 not one has failed either in centre or tire. A section of wheel in the exhibit shows how completely the two metals are joined. These wheels are shown as large as 42 in. There are also spoked engine truck and street car wheels.

The *Griffin Car Wheel Company*, of Chicago, shows its ordinary cast iron wheels for steam surface and street cars. There are 33-in. 600-lb. wheels and 36-in. 700-lb. double plate wheels. These latter are shown in the pattern used by the Illinois Central Railroad. The class of wheel used on the Intramural road is also shown.

The *New York Car Wheel Works*, of Buffalo, have cast iron car and truck wheels ranging from 12 to 42 in. in diameter, and street car wheels from 22 to 36 in. in diameter. The 42-in. wheels are of the double plate type.

Grouped together in one exhibit are wheels made by the *Northwestern Wheel & Foundry Company*, of St. Paul; *Rochester Car Wheel Works*, of Rochester, N. Y.; *Terre Haute Car & Manufacturing Company*, of Terre Haute, Ind.; *Barnum & Richardson Manufacturing Company*, of Chicago and Salisbury, Conn.; the *Dickson Wheel Company*, of Houston, Tex.; and the *Chicago, Milwaukee & St. Paul R. R.*; each of these companies uses the Barr contracting chill and shows wheels cast in that chill. There is one wheel cast in the ordinary solid chill and another cast in the contracting chill, and both have made about the same mileage. The former shows the flat spots so frequently found in cast iron wheels, while the latter is to illustrate how evenly the wheels, cast in such chills, wear, and that they remain nearly a true circle. One of the Barr contracting chills is shown in the same space, and also one of the grinding machines.

The *Cushion Car Wheel Company*, of Indianapolis, and the *St. Louis Car Wheel Company*, of St. Louis, have their exhibit of wheels arranged with the exhibit of the Bass foundries. The former has one of its wheels with a record of 183,840 miles, made under combination car No. 51, of the Indianapolis, Decatur & Western. The largest wheel shown by this company is 42 in. The company shows also the wheel centre before the tire is put on and the method of holding the rubber cushion in place. The St. Louis Car Wheel Company exhibits cast iron wheels cast in contracting chills, but does not show the chill or the grinding machine. One of the wheels deserves particular mention; the web between the spokes has been knocked out all around the wheel without cracking the plate.

The *American Steel Wheel Company* exhibits cast steel car and driving wheels, one of the former 33 in. in diameter, having made 122,860 miles under combination car No. 42 of the Central Railroad of New Jersey.

The *Paige Car Wheel Company*, of Cleveland, is located somewhat north of the general wheel division of the building. On one side is shown the cast steel centre near it another centre with one plate and the tire attached. There is also a wheel with a segment of one plate cut out to show the manner of fastening the parts of the completed wheel, then there are several samples of the finished wheel. One wheel in the collection has made 804,631 miles on the "Fast Mail" between Chicago and New York.

FARNLEY IRON COMPANY'S EXHIBIT.

A fine showing of high grade wrought iron is made in the Mines and Mining Building by the Farnley Iron Company (limited), Leeds, England. The iron manufactured by this company is of the highest grade obtainable and is used by many of the English and Colonial railroads for fireboxes, drawhooks, and in other places where the use of high priced material is justified by increasing the safety. The light drawhooks used on the foreign cars and locomotives at the exposition have been a source of surprise to American railroad men who are accustomed to the heavy couplers used here. The foreign hooks and links are made of the best material obtainable. The Farnley iron is made from ore which is smelted in cold blast furnaces, remelted, refined, puddled, hammered and rolled, producing the results described over leaf.

This company makes the fine iron used in locomotive fireboxes, and a plate exhibited has been punched and sheared and twisted and bent in all conceivable ways, with the fibre and across it, and shows no sign of crack. It is reported that there is some inquiry for this material from American railroads to be used in fireboxes. Some specimens of bar iron shown, varying in diameter from one-half an inch to two inches, have been twisted and tied into knots without showing cracks or other defects. This iron is made to stand from 50,000 to 60,000 lbs. tensile strain per square inch, with an elongation of 30 per cent. in 10 in. and a reduction in area of 55 per cent.

A feature of this exhibit, which will be of interest to railroads, is a pressed steel journal box for cars. This was not made by the Farnley company, but is included in its exhibit. The box is pressed into shape and the joint welded in a gas furnace with pneumatic percussion hammers. The bottom is pressed separately

and welded to the sides of the box in a similar manner. The box costs the same as the ordinary cast iron box, but weighs one-half as much.

CAR SEATS.

The Scarritt Furniture Company, of St. Louis, has fine samples of its specialties in the line of car furniture. The company has recently put on the market a new car seat with a reversible and adjustable back, which is a most comfortable seat in whatever position it is placed. There are also single and reclining chairs and double seats for day coaches, all provided with the Forney system of levers. There are also double seats that can be turned up for a reasonably comfortable berth or a good card table. There is the adjustable chair with Mr. Scarritt's latest design of adjustable footrest for drawing-room cars. Both these and the reclining chairs for day coaches are remarkable in the ease with which they are changed from one position to another, leaving nothing to be desired in this respect. Some of the seats are covered with rattan; these are for use in Southern countries. The arrangement of all the seats shown is such that the car cleaners can readily turn them up when cleaning beneath them, a decided convenience. Much of the space alloted to this company is occupied by a platform raised a foot or more above the adjacent floor, and on this the seats are displayed. Around the four vertical sides of the platform extends an endless belt bearing large cards on which are the trade marks of the various roads using the Scarritt seats. The belt is driven around by a small electric motor. The firm is represented by Ben Deering.

H. A. Wheeler, of Chicago, makes a special exhibit of his No. 32 Wheeler seat, which has been so well received by many railroads. There are also shown double and single reversible seats, upholstered in various plushes, and some with rattan bottoms and backs; reclining and revolving chairs for day and drawing-room cars; wicker chairs, with and without plush covering, and reclining drawing-room chairs with adjustable footrests.

The Frost Veneer Seating Company has a pavilion in which are arranged veneer seats and settees for stations and cars.

The Wakefield Rattan Company, of Boston, exhibits reversible seats and revolving chairs upholstered in plushes of various shades and qualities, and others with rattan seats. There is one wicker revolving chair in the exhibit.

The Hale & Kilburn Manufacturing Company has a large pavilion filled with finished car seats and some that are unfinished, showing the material put into the seats and the method of making them. Some of the seats shown are upholstered in plush, some in leather, and others have rattan or slat bottoms. There are also shown rolls of canvas-lined rattan, a specialty of this company. The feature of this exhibit that will attract most attention from the ordinary visitor is a triple pedestal at the south side of the space occupied by this company; it is painted in a very pretty ivory, and on three panels are figures representing Decoration, Woodwork, and Upholstering.

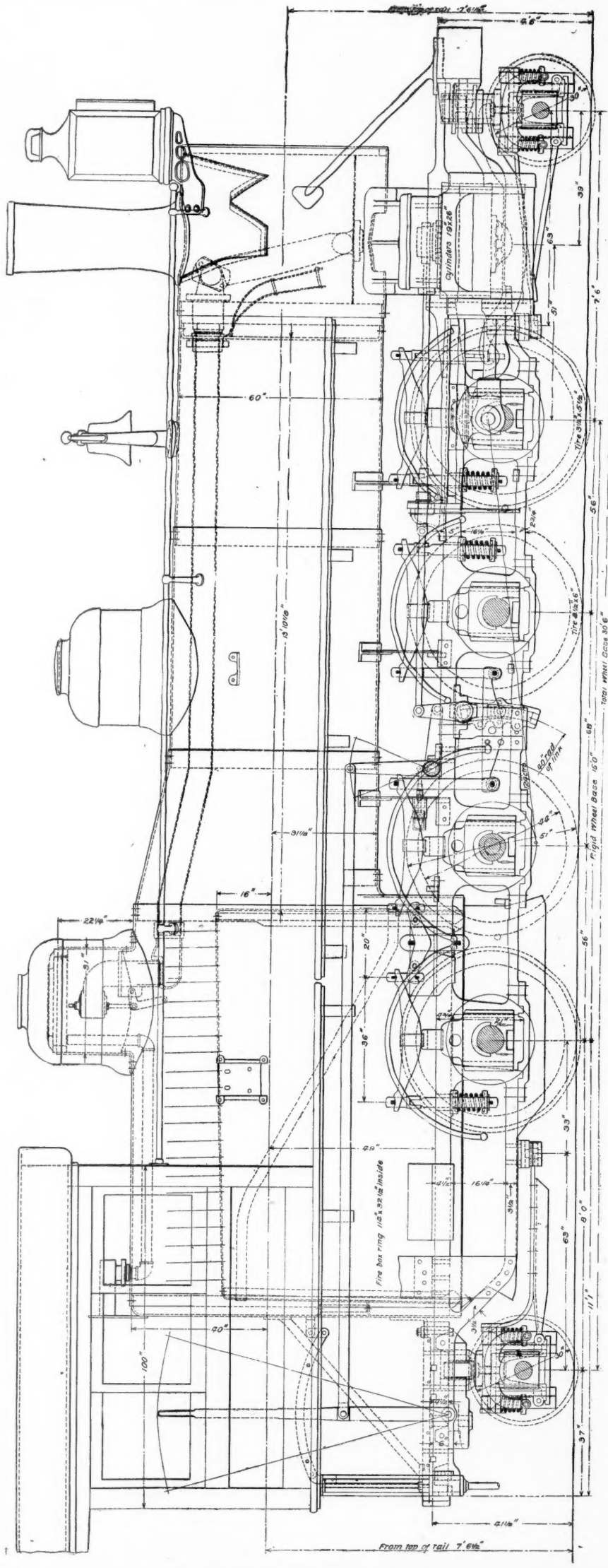
Stannard & White, of Appleton, Wis., have an exhibit of the "Brotherhood" seat for locomotive cabs, which has been on the market for about two years. The bottom of the seat is supported on a main central spring and pivoted to the corners of the seat and the base; fulcrumed at the main seat spring in the middle are four levers, making a perfectly balanced spring platform, which keeps the seat level whether the weight is on the corner or in the middle. This seat has been very well received by locomotive engineers and firemen, for whose comfort it was designed.

Double-Ender Freight Transfer Locomotive—Calumet Terminal Railway.

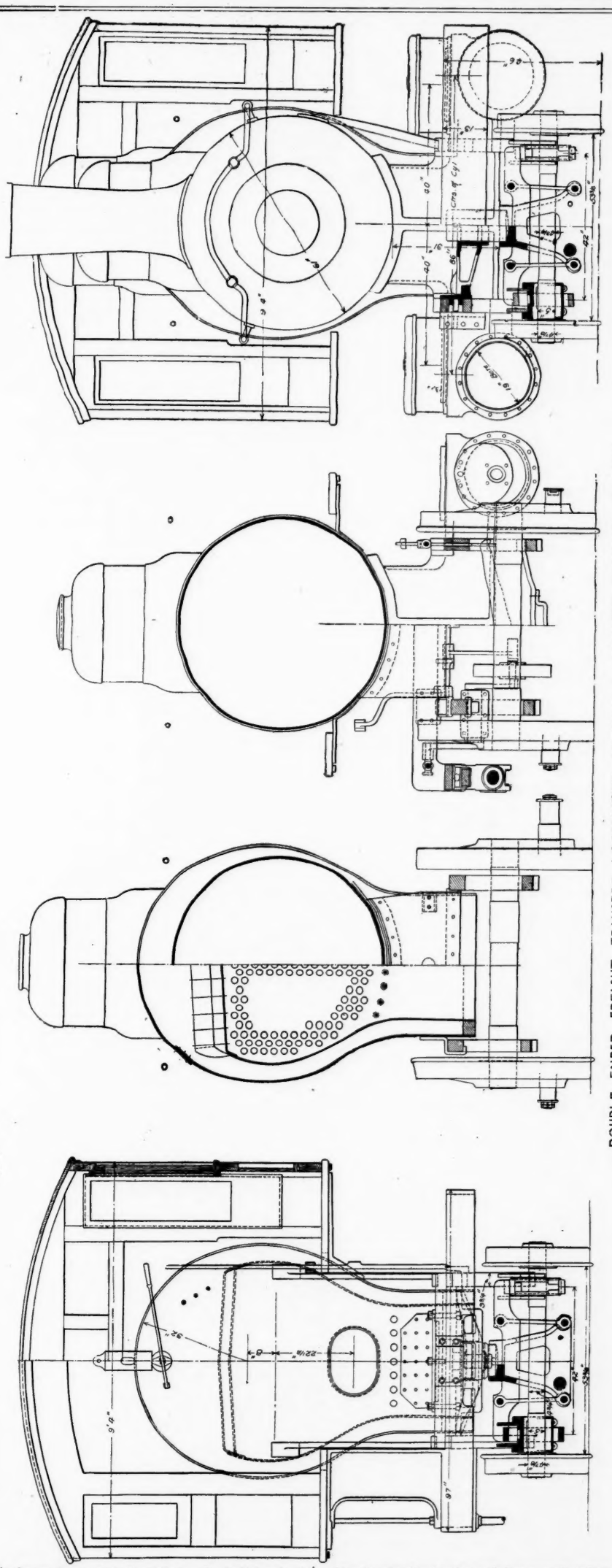
The Brooks Locomotive Works have recently designed and built for the Chicago & Calumet Terminal Railway, from specifications furnished by Mr. James McNaughton, Superintendent of Motive Power of the road, some "freight transfer" locomotives of the general design shown in the engravings. We are indebted to the builders for the drawings and specifications. These locomotives are called "double enders," but they are not double enders in the strict use of the term. "Double-ender" means a locomotive built to run as well in one direction as in the opposite, and these do not do so more than all switching engines, for they have a separate tender. The Johnstone "double enders," recently built for the Mexican Central, and the Fairlie "double enders" are built to run in either direction.

The trucks under the engine illustrated are to carry a part of the weight rather than to act as guides, for the swing links are too long to allow the trucks to be of much service as guides. Two equalizers extend from the forward spring hanger to the leading truck and distribute the weight of the cylinder castings on the front driving wheels and the truck.

A trailing truck is not generally used under engines designed for service requiring all available adhesion, such as switching and freight service, but it has been used under several locomotives of recent design for fast passenger service. In the design of the Chicago & Calumet Terminal locomotive, the top member of the frame extends back under the footplate in a tongue shape similar to the front end. The lower member is parallel with



DOUBLE ENDER FREIGHT TRANSFER LOCOMOTIVE—CHICAGO & CALUMET TERMINAL RAILWAY.
Built by the BROOKS LOCOMOTIVE WORKS, *Dunkirk, N. Y.*



DOUBLE ENDER FREIGHT TRANSFER LOCOMOTIVE—CHICAGO & CALUMET TERMINAL RAILWAY.

the main frame to a point about five and a half feet back from the centre of the back driving axle; this leaves room for the trailing truck under the tongue. The cross-tie, which supports the end of the radius bar, is bolted to the lower member of the frame. The radius bar of both front and back trucks is 63 in. long from the centre pin to the centre of the truck axle. The design of the radius bar for the back truck is somewhat different from that of the front truck, as it was necessary to keep the former low enough to clear the ashpan. The arrangement is clearly shown in the side elevation. The truck wheels, both front and back, are cast iron, double-plate pattern, 30 inches in diameter.

The smokebox is short, as it is equipped with the Bell spark arrester, which is now receiving considerable attention. One of the advantages of this device is that it allows the use of a shorter smokebox, which lessens the weight on the truck. With it there is a large area of netting and a more uniform draft on the fire than is ordinarily obtained. As shown in the side elevation, the arrester consists of the double plate deflector supported from the tube sheet just above the top row of tubes. The plates are perforated and are separated several inches at the lower end. The perforated plates and wire netting with meshes 2×2 in., of which the basket just below the stack is made, are placed at very sharp angles with the direction of the currents passing to the stack, so that the cinders, carried through the tubes by the sharp blast, are ground very fine and are quickly extinguished when finally thrown from the stack.

The crown sheet of the firebox is supported from the roof sheet by means of crown bars and swing stays, the bars being also supported on the edge of the side sheets. The crown sheet is 16 in. above the center line of the boiler at the front end and 13 in. above at the back end; it is also higher in the middle than at the sides, but from the bend in the middle to the bends at the sides the sheet is straight. The water legs are 3½ in. wide at the bottom.

The firebox is placed between the frames; it is provided with a brick arch supported on three No. 6 water tubes 3-in. in diameter, extending from the throat sheet to the upper part of the back head. It is also provided with the Barnes patent smoke consumer. The barrel of the boiler is supported by three expansion braces.

The locomotives are single expansion, and the boiler is designed to carry a steam pressure of 180 lbs. to the square inch. Some of the principal dimensions are as follows:

Gauge	4 ft. 8½ in.
Cylinder	19 in. diam. × 26 in. stroke
Drivers, number	4 pairs, coupled
" diameter	51 in.
Wheel base, rigid	15 ft.
" total	30 ft. 6 in.
Weight on drivers, working order	120,000 lbs.
Weight on trucks	30,000 lbs.
" total	150,000 lbs.
Weight of tender, loaded	70,000 lbs.
Boiler, type	Wagon top
" diam. smallest ring	60 in.
Tubes	Lap welded C. I., No. 13 B. W. G.
" number	250
" diameter	2 in.
" length	13 ft. 1⁰ in.
Firebox, length	114 in.
" width	33 in.
Stack, smallest diam.	16 in.
Boiler material	Steel, ⅛, 9/16, and 5/8 in. thick
Journals, main	9½ in. long. 8 in. diam.
" truck	5 in. diam.
Height, centre of boiler above rail	7 ft. 6¼ in.
Height, top of stack above rail	14 ft. 7 in.
Tank capacity	4,000 gals.

Some of the special devices specified for these locomotives by the railroad company are:

The Bell spark arrester.
Barnes smoke consumer.
Two 3-in. consolidated encased pop valves.
"Neroth" ashpan.
Pedrick & Ayer oilcups on guides, etc.
United States metallic packing, old style, on piston rods and valve stems.
Reverse lever and quadrant; Player patent.
Richardson balanced valve.
No. 9 Nathan lubricator.
One No. 8 and one No. 9 Monitor injector.
National hollow brakebeams on tender.
Crosby chime whistle.
Westinghouse, American, schedule "XIV." brakes.
The Gollmer bell ringer, operated by air.

Metal Ties in Mexico.

The Mexican Railroad has now some 150 miles of track, including the Pachuca branch, laid with steel ties which weigh 124 lbs. each, or 126 lbs. with the two key bolts. These ties are 8 ft. 3 in. long, rolled so as to have a longitudinal web, and have clips for holding the rails formed by cutting slots out near either end of the sleeper and bending up the steel. The first metal ties of crude design were placed on this road 14 years ago. On the Inter-Oceanic Railroad some 50 miles had been laid with "pot" sleepers, an English monstrosity consisting of two cast iron dishes oval in form, which were inverted in the ballast and connected together by wrought iron bars, the rails being keyed to the pots. About one-fourth of these have been replaced by steel sleepers, and further replacement is made as rapidly as finances permit. The steel sleepers now used are 6 ft. long, weigh 90 lbs. each, and have near the ends square bolt holes, but no clips. These nest nicely for shipping, and cost $1 gold, per sleeper, delivered at Vera Cruz. Wooden ties 8 ft. × 6 in. × 6 in. cost in the vicinity of Pueblo and Mexico 63 cents for pine and 95 cents for oak, therefore at the present exchange the pine ties cost in gold 42 cents, and the oak ties 64 cents each; as railroad supplies pay no duty the expense for steel ties is therefore not greatly in excess of wood. On the Southern Railroad (3-ft. gauge) steel ties 8 ft. long, weighing 110 lbs. are used.—*John Birkinbine, Engineers' Club of Philadelphia.*

Railroads in Natal.

The first railroad constructed in South Africa was in Natal, from Durban to the Point, opened in 1860. By the completion of the line to Harrismith, in the Orange Free State, there are now 399 miles of railroad in operation. The following table shows the results of operations during the past six years:

Year.	Gross revenue.	Working expenses.
1887	£257,877	£173,931
1888	347,982	199,363
1889	535,260	300,247
1890	606,713	416,396
1891	572,296	372,023
1892	532,788	365,704

A survey of an extension of the Natal line on the route from Charlestown to Elsburg, near Johannesburg, has recently been completed, and a convention for the construction of the line has been concluded between she governments of Natal and the South African Republic. —*Industries.*

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

For 17 years there has been printed annually in the reports of the proceedings of the Master Car Builders' Association a preamble and resolution adopted at the Ninth Annual Convention of the Association. That preamble and resolution sets forth that in view of the growth of the practice of entertaining members of the Association, and of the large expenditure of time and money that had become customary as long ago as 1875, and in view of the humiliating interpretation that might be put upon the motives of the entertainers, and and of those who accepted the hospitality, the Association thanked its friends for their past liberality and requested that in future there should be no more expenditure of money for the public entertainment of members. Whether or not this action ever produced any effect we do not know, but in recent years the wish of the Association seems to have been entirely forgotten. At Lakewood the other day the new Executive Committee instructed the Secretary to address a letter to the Entertainment Committee of the supply men, asking their attention to the expressed policy and wish of the Association as recorded in the resolution above cited. We question if this will have much effect, but it is a pity that it should not. It has seemed a duty from year to year to speak of this matter in connection with the conventions of the Master Car Builders', Master Mechanics' and Roadmasters' associations for the expenditure by the supply men for the entertainment of the members attending these conventions has become more and more prodigal. It has come to be a serious burden upon many of the supply men, and indeed, we question if most of them do not feel that it is a tax that they ought not to pay, but which they lack the courage to refuse to pay; and on the other hand the custom puts the members of the Associations in a very undignified light. Hospitality is not only a pleasure but it is a sacred obligation, and it is by no means peculiar to high civilization, but is practiced even by savages. But all men, savage and civilized, recognize that to be dignified it must be reciprocal. A man does not ask his friend to dinner with the purpose of sone time getting another dinner in return, but at the same time invitations of that sort cannot continue for a great while to be entirely one-sided without having a bad effect on the minds of both men. It would be an extraordinarily generous person who would not think the less of a friend who constantly accepted his hospitality and never returned it. On the other hand the man who accepted favors of this sort and never returned them would be an extraordinarily thick skinned or singularly unworldly man if his own self-respect was not lowered by the practice. The application of such well recognized and fundamental principles to the cases in point is obvious.

Last week the M. C. B. Association treated one important matter with but very little of the serious interest which it deserves. When the Secretary read his report on the value of different materials for brakeshoes and recommended that some of the surplus funds of the Association be devoted to defraying some of the incidental expenses attending a set of tests that are absolutely necessary before railroad men can know within 25 to 50 per cent. what is the relative value of the various materials for brakeshoes, the proposition evidently met with favor; but then some of the members began to question the advisability of permitting the Executive Committee to expend money without very definite limits. This led to a useless discussion about book-keeping, and only by a small majority, and this only by chance, was the proposition saved and referred to a committee to report on the proposed expenditure and a plan for making the tests. It must seem strange to those who fully realize what an important body the M. C. B. Association is, that such a vital matter as the friction of brakeshoes, of which all are comparatively ignorant, should be treated so lightly by men who have been long enough in the Association to know how much really good work in experiment and investigation has been done by the various committees. The plan is to make such observation as will be necessary to settle within reasonable limits the following questions:

1. What is the comparative friction of long and short shoes?
2. What is the comparative friction of various grades of cast iron, composite and steel shoes?
3. What is the comparative durability of these shoes?
4. What is the effect on steel tires and chilled wheel treads of these shoes?
5. What is the most economical material to adopt as a standard brakeshoe metal for cars used in interchange traffic in order to keep something like a uniform braking power and to prevent slid wheels?
6. What is the best material for use on steel tires and chilled wheel treads?
7. What is the safest and best material for brake shoes for high-speed passenger train to be used with the reinforced air brake?
8. Are the present air pressure, brake leverage and cylinder area sufficient for use with the most economical material for brakeshoes?

It does not require much argument to show that tests are necessary when it is remembered that the friction of the various shoes varies fully 50 per cent., and that when the brakebeam pressure is adapted for one class of shoe it may be more than enough to slide all the wheels in a train if a different shoe is used. And, on the other hand, if the arrangement of the power is for a shoe with great friction the result with a shoe that has less friction would be a wholly inadequate braking force. Technical schools and private experiments have made many laborious experiments and collected much data about friction of metals, but none of it bears directly upon the point in question; therefore, about this important subject there is now but little known. It is to be hoped that a capable committee will be appointed and that the work will go forward with dispatch.

The Southern Railway and Steamship Association held its annual meeting in New York last week, and, as usual, the officers declined to tell the reporters anything definite about what was done. But the reporters (those who aim to stick to the truth) could not bear to print less than half a column about such an important association, and so they each filled up about that amount of space with an account of the rate cutting and general demoralization which are alleged to be putting the life of the Association in jeopardy. The general impression gained from reading these reports is that the rate cutters are very active and that matters are constantly growing worse. But a prominent member of the Association tells us that this evil is really less troublesome instead of more so, and that the past year has been more than ordinarily peaceful. The reporters probably got their information from individuals outside, and probably were not misinformed, if a strict construction were placed on the words used; but the excessive amplification to which their necessities compelled them to resort made their stories practically false. This Association imposes fines for rate cutting, and conducts these matters with less fuss than some others do; and the fines are paid. Perhaps the reporters are pardonable for assuming that misconduct which necessitates such heavy fines is a pretty serious matter, and so it is; but that does not alter the fact that cut rates affect but a mere trifle of the business of the Southern roads. We said that the reporters were probably not misinformed; but that one who stated that a dozen officials had already lost their positions because of rate cutting must have been, and very badly, for nothing of the kind has occurred.

An interesting letter on experience with fusees will be found in the contributors' column of this issue. A trainman who intelligently observes facts and circumstances in a way to get a good understanding of the principles of his calling *and* who writes out his ideas in readable shape is rarely found, but this letter is from just such a man, and is worth reading. The *Railroad Gazette* has persistently urged the adoption of the block system, and in so doing it has paid little attention to the flagging system as a means of preventing rear collisions, for the strongest argument in favor of of the use of the block system is found in the long and successful experience of the railroads of England in its use, and those roads do not depend upon the brakeman for protection. Flagging is an "absurdity" on a busy road, as a distinguished correspondent pointed out in these columns some time since; although it is true that the English roads, like those in this country, keep the flagging rules on the standard code book with all the formidableness of the old times when such rules were really of vital importance. But whatever we may say about English managers, it is true that in this country managers who adopt the space interval system not only retain all the brakeman's rules used with the time-interval system, but expect him to carry them out: and, this being the case, we print this argument in favor of fusees for the benefit of such managers. If flagging rules are to be used at all they should be the best attainable rules in their sphere. One of the chief defects of the flagging system is that on most large roads it necessitates rules which cannot always be carried out, and thereby impairs the general discipline of the service, but this impairment of discipline is just as objectionable after the establishment of the block system as it was before, and every possible improvement in the flagging system should therefore be as desirable now as ever before. One of the most troublesome things connected with flagging rules is to make them provide for protection when a train is losing time but is not compelled to stop, and the fusee is peculiarly applicable to this need.

The statement of our correspondent, that enginemen do not shut off steam when they encounter a torpedo signal which tells them to prepare to stop, is doubtless open to two interpretations. In many cases the torpedoes are placed in such a locality that the engineman really holds his train under control while still using steam: his speed may already be slow or the grade may be favorable to quick stopping; and whenever practicable a careful brakeman will place the torpedo on a piece of straight track. On the other hand every one knows one or more of those enginemen who like to take a little risk now and then and who have a constant tendency to use their own "judgment" as to the whereabouts of the preceding train instead of accepting the authority of the only person who does actually know about it. It is not surprising to be told that men of this kind are still in the service. But this kind of contempt for instructions is no harder to detect and punish than several other kinds, and it certainly ought to be detected. Probably very few roads will throw aside torpedoes because our correspondent says they are antiquated, and as long as they are used the men ought to be made to obey them. In this connection the very sensible rule of the Erie road in regard to torpedo signals should be noticed. On that road there is a provision, in connection with Rule 30, that if, after running one mile, no danger signal is encountered, full speed may be resumed. This makes obedience to the rule pleasanter to an engineman who is behind time and anxious to avoid delay, and consequently makes enforcement easier.

The Vertical Plane Coupler at the Lakewood Convention.

The aspect of the M. C. B. coupler question is now much improved, and all concerned feel that the ground is more solid, and something like a permanent foundation has been established. No longer need the malleable iron manufacturers feel that the Association may be led into exorbitant demands for strength in buffing and pulling; and the steel makers need have no fear that the price per car wil be reduced to a point below a living profit.

Malleable iron has been conclusively proved to be fully equally to the requirements of the proposed tests, but to reach this the makers must put in better iron, and use more expensive methods of manufacture. This will raise the cost of malleable iron somewhat, and lessen the former wide difference between the cost of the two materials. On the other hand, the steel makers must reduce their processes of manufacture to a system and avoid the waste that is now common with them. When this is done and steel makers secure orders for large

lots, and thus gain the economies of routine production, the element of price in competition will be less than heretofore and merit in details of construction and operation will be more of a factor in selling than it has been since the M. C. B. standard was adopted. Whatever has been the feeling about tests and investigations before this, there is now but one fair opinion, and that is decidedly in favor of the closest scrutiny of material and complete examination with the most improved apparatus. Always the same examination for each succeeding shipment and identical treatment for all the different makes of couplers ought to increase confidence and strengthen the trade of every honest manufacturer.

In the next few years great numbers of couplers will be purchased and after the present business depression the influx of orders will probably tax the capacity of all the established makers, and for these and other reasons the railroads ought to feel more at ease by reason of the practically final settlement upon a means of distinguishing between a really dangerous coupler and a safe one. Nothing more unfortunate can be imagined to happen in the equipment of railroads than placing a large percentage of weak couplers on the million and more freight cars in this country. The bearing of such a misfortune on the question of interchange of cars would be so general and cause so much dispute at inspection points, and in settlement for defects, as to seriously hamper through freight business. In Chicago, which is now the principal transfer point, the joint inspection question has become so vital and important (made so by incompetent and defective car details) that it is being taken up by the highest officers of the railroads entering the city, and as the only way to reduce the great expense and annoyance of delays in the transfer of cars. The master car builders of these roads have shown themselves quite inadequate to handling the question, not because of their incompetency, but for lack of power to act. The question is a far-reaching one and affects the earnings of through roads so much, and is so complicated, that the presidents and general managers must agree upon new methods of auditing repair bills and agree to abide by the decisions of abitrary and local inspection.

These remarks may seem somewhat foreign to the coupler question, but they are not. This will appear from one pertinent question, Who shall pay $20 or $22 a car for couplers when on a foreign road when the railroad breaking the coupler knows that the device was weak and made of poor material? Evidently, if the road breaking couplers should pay for them or replace them, then a short road equipping a large number of cars with cheap couplers would profit considerably and would cause injustice to foreign roads, as its cars would be mainly used away from home and it would get credit for a good coupler while it supplied a bad one.

All this leads up to the point being made, which is, that the only protection to railroad companies that use honest material and receive cars in interchange lies primarily in the M. C. B. Association itself, and secondarily in the decisions of that body regarding standards and the means to be used for distinguishing the good from the bad.

If, after this time, all railroad companies tacitly agree to purchase only such couplers as will fully meet all of the proposed M. C. B. Association requirements, there will be no hardship to any individual road and a threatened difficulty of no small proportions at interchange points will be avoided. But, on the other hand, if such a tacit agreement be not reached, then the time will be, within the short period of the next five years, when cars having some makes of couplers, in apparently perfect condition from a cursory view, will be received only with a M. C. B. defect card, and perhaps will not be received at all.

The main reason for not receiving cars with a defect card for defective couplers, defective not in structure but in design and material, is that the final cost of a broken coupler does not rest with the price of its replacement. The main cost is the indefinite, but nevertheless enormous, expense of delays, wrecks and damages resulting from the failure of the coupling devices to hold the cars together. A low estimate of the average cost of breaking a car in two parts while running shows about ten times the cost of the replacement of the broken coupling, and if the trains have not the automatic air brake this ratio is very much increased. Not long since we saw six dressed beef cars and their contents strewn along the track as a result of a defective coupling. In strict justice, was not the total cost of this wreck chargeable to the owners of the cars who used a coupling device known to be weak? Rigid conformance to the M. C. B. standards and rules throws the responsibility of failures in service very largely upon the Association, and as nearly all roads are, or should be, parties to the Association, the final responsibility of failures in service of devices when under ordinary working conditions lodges with the railroads as a body, and that is where it should rest. But disregard of the standard and the proposed and adopted tests on the part of an individual road leaves the responsibility for failures of non-standard devices on foreign roads with the individual and delinquent road, and a few wholesome examples in a United States court of equity would have a good effect in reducing the number of haphazard purchases that are made by roads which ignore the decision of the competent body of men composing the Master Car Builders' Association. Any excuse there may have been for haphazard action in regard to the M. C. B. car coupler in the past is now removed by the final establishment of the real practical value of the proposed tests, and this and what precedes is such argument as is now very apparent to show why both the coupler makers, because they know now what to work for, and the railroads, for they now know what to buy, should feel gratified with the vindication of the proposed means of distinguishing a safe from a dangerous and therefore expensive coupler.

Outside of the general features of the results of the tests and their proper bearing upon the selection of couplers there are some very important matters of detail, both in design and material, which make the results more important than any since the famous Burlington trials.

The tests at Chicago, Altoona and Watertown have shown more or less conclusively:

(*a*) Malleable iron in its best form is vastly better than the average cast steel for coupler heads.

(*b*) Cast steel varies as much in quality as malleable iron.

(*c*) Malleable iron drawbars can be made to meet the proposed tests provided good stock is used and the manipulation of the process is correct.

(*d*) The limit of weight, viz., 120 lbs., is not too low for either malleable iron or cast steel.

(*e*) Neither malleable iron nor cast steel is to be relied upon without constant examination by test and scrutiny of manufacture.

(*f*) Malleable iron is inadequate for knuckles.

(*g*) Little is known about the strength of guard arms, and such knowledge as is available leads to the suspicion that the guard arms of both cast steel and malleable iron couplers are inadequate to stand the blows of service and that something must be done in the way of changing the M. C. B. standard depth or breadth of shank, or distance from face to buffer stop, before it will be possible without considerable increase of weight to give to the guard arm the resisting power that it must have to be equal in strength to the other parts of the coupler.

(*h*) Cast steel is a much stronger material than malleable iron and can be made into couplers that will greatly exceed the proposed requirements. But there is nothing to show that there is any advantage in paying more for couplers than will purchase those of good design and that will just meet the requirements, except in the single detail of guard arms. That it will be necessary to use the better grades of higher priced steel to gain the required strength in this detail is somewhat doubtful, as it is very evident that a reasonable change in dimensions that will not affect the interchangeability will permit the cheaper grades of material to be used and yet give a wholly adequate guard arm.

(*i*) When knuckles are properly designed and made of good cast steel or wrought steel, or wrought iron, the strength of a single lug either top or bottom may be made sufficient to meet the M. C. B. requirements for both lugs, and examination of knuckles should always include a "single lug" test.

(*j*) Slots and holes in the shanks for the purpose of the attachment of draft gear, or for supporting the cores in casting, do not necessarily weaken the coupler under service condition, although they may greatly affect the showing of a coupler in a drop test. This arises from the fact that the drop test is not intended to reproduce the conditions of service, but to test material; just as an axle is struck in the centre during test, while in service it receives no such blow. In all service work where couplers are properly put on the cars the coupler is supported by the buffer stop, and not by the end of the shank when under severe blows.

(*k*) The tail bolt connection is inadequate and unreliable, mainly owing to the common defects in the manufacture of the bolts and the rapid wear of the drawhead where the head of the bolt bears. The tail strap is preferable, is wholly adequate and the lugs for its attachment should always be cast solid with the shank and not be separate as is called for by the current volumes of the proceedings of the M. C. B. Association. The turning down of the ends of straps to hook over the lugs on the shank is quite unnecessary as the rivets have sufficient strength to hold the straps under all service conditions, and the turned down ends break off frequently and are not to be relied upon.

(*l*) Pivot pins should be made of a high carbon (stiff) steel; otherwise a strong coupler may be made weak by the bending of the pivot.

(*m*) Knuckles in pulling tests do not fail by cracking or breaking out in the front face, as they do in service. This is due to the fact that stiff (high carbon) pulling pins are used, of a size that completely fills a pinhole in the knuckle, and also it is somewhat due to the steady pull in the machine. A sudden blow or pull generally produces a different result from slow and steady movements.

(*n*) Couplers with the knuckles well supported in the coupler heads generally stand drop tests better than those which depend solely upon the pivot pin for support. Also those couplers having knuckles which cover the front of the pivot lugs stand better than those which have those lugs projecting to the face of the knuckles.

(*o*) Simplicity is a desirable feature of all railroad devices, but the least number of parts in a coupler does not necessarily make the simplest design. In some of the reports, notably the reports of the Chicago tests, the number of part was incorrectly stated, and in other cases the use of a washer or clevis, both of which might have been omitted without affecting the operation of the coupler, would make it appear that some of the simplest and most practical designs are complicated. Simplicity should be understood to mean in this case that there are few important parts and that these parts have a simple shape and function, and are not liable to be lost, broken or to get out of order, and can be readily reproduced.

(*p*) Chemical analysis will show that any material is bad or liable to be bad, but it will not tell that the material is good, as a material good in composition may be spoiled in casting. Although the material may be bad if the chemical analysis shows it to be good, yet it can never happen that it will be good if the analysis shows it to be bad.

(*q*) Couplers are now made and sent out so inaccurately built as not to couple with each other and far from the M. C. B. standard contour. This shows that the wishes of the Association as expressed by the adoption of standard gauges are not being complied with by the manufacturers; and that some of the railroads parties to the Association are ready to receive couplers that are not serviceable in spite of the fact that their mechanical representative has voted to adopt the standard limits of variation from the true contour. It is of course true that the limits are narrow and that much care is required on the part of the manufacturers to keep within them, but some have done it and are doing it, and all delinquents can come nearer to the gauges than they now do. It is clearly evident that there is no excuse for one-quarter of an inch over the allowed limit. Some of the couplers sent for tests were so badly built that they would not couple with each other under the most favorable conditions.

Such are a few of the results of the recent tests to which some have objected, and they are offered to the objectors for consideration as to whether the action of the M. C. B. Association committee has been justified by the results.

A Ship Canal from Lake St. Clair to Lake Erie—Will it Pay?

If the statements which are going the rounds of the press are reliable, the cut-off canal from Lake St. Clair to Lake Erie will soon be under construction. It is said by the promoters of the scheme that the money required has been subscribed and the necessary legislation promised by the Dominion Government, and that the work will be completed inside of two years. A little analysis of the scheme is therefore not uninteresting.

The distance by the river route from the St. Clair Flats Canal to the junction with the proposed cut-off in Lake Erie is 105 miles, and by the proposed canal 50 miles, making a saving in distance of 55 miles. The question whether or not the enterprise will pay depends on whether the time saved by a vessels going by the shorter route will be worth the interest on the investment required to construct the canal.

The canal will be about 14 miles long, and will have to be cut through land varying from 5 ft. to 40 ft. above lake level. No statement has as yet been published giving the depth and width of the proposed canal; but to accommodate the steamships that will be placed in the lake service when the improvements now being made to the lake waterways are completed, will require at least a cross-section of 21 ft. depth and 200 ft. width at water surface. Such a cross-section would require about 20,000,000 cubic yards of excavation for the canal, and about 3,000,000 cubic yards for channels in Lake St. Clair and Lake Erie. Assuming that no rock excavation will be required, which as yet has not been determined, the cost of cutting the canal —estimated at 15 cents a cubic yard—would be $3,450,000 which with cost of entrance piers in Lakes Erie and St. Clair, land damages, commissions, engineering and office expenses will make a total of not less than $4,000,000. Probably no capitalist will care

to take chances in such an enterprise on estimated profits of less than eight per cent. on the investment, or an annual net income in this case of $330,000.

The total tonnage passing Detroit River may be estimated at 30,000,000 tons a year, one-third of which will go by the river route, even if the canal route be made free from toll. Tolls of at least 1½ cents a ton will therefore be required in order that the revenue shall be sufficient to pay interest on the investment.

By the time this canal could be completed, the freight carriers of the lakes will have a capacity of 2,000 to 5,000 tons each, or an average capacity of about 3,000 tons, and at present freight rates will be capable of making about $48,000 gross earnings in a full season of 300 days.

As the speed of the steamer in the canal would be only about one-third of that in the open river, the time saved by going through the canal would be only about one and one-half hours per passage, the value of which, as determined from gross earnings for the entire season, would be, say, $15, or one-half cent a ton for freight carried.

It is therefore evident that, as the highest rate of toll that vessel owners could afford to pay is only one-third of that needed to pay interest on the cost of the enterprise, the promoters of the scheme must have some other source of revenue in view. If Canada could be annexed to the United States, the strip of land between the Detroit River and the canal would, no doubt, become very valuable, but until then there is no more reason why a city should be built up along this canal than along the Welland Canal, which is similarly situated in reference to Buffalo.

Analysis of Compound Locomotive Tests on the Old Colony Railroad.

In the *Railroad Gazette*, April 14, was published a letter from Mr. F. W. Dean, Mechanical Engineer, giving the results of some tests of a compound locomotive designed by him for the Old Colony Railroad Company. A peculiarity of the results was a very low water rate per

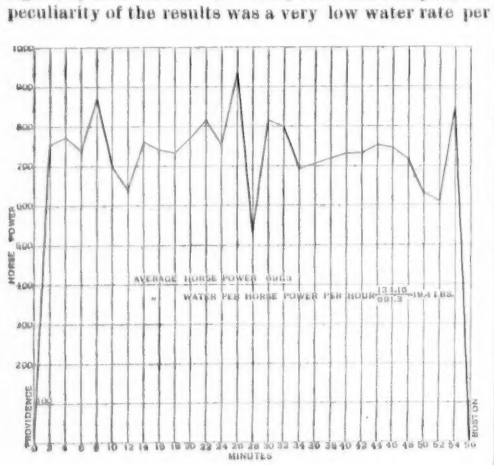

Fig. 1.

horse power per hour, the amount being 18.8 lbs. These results having been questioned by several of our correspondents, we have analyzed them, and the analysis is given in the following tables.

TABLE B.—ANALYSIS OF TESTS OF DEAN COMPOUND LOCOMOTIVE.

Number of indicator card.	Revolutions per minute.	Water used each 2 min. measured from low-pressure indicator card. Pounds.	Indicated water per H. P. per hour, low-pressure cylinder. Pounds.	Steam per stroke high-pressure cylinder indicator card. Pounds.	Steam per stroke low-pressure cylinder indicator card. Pounds.	Per cent. increase of steam in high-pressure cylinder. L	Per cent. increase of steam in low-pressure cylinder. M.	Apparent condensation between high and low-pressure cylinder. Per cent.	Apparent reheating between high and low-pressure cylinder or leakage of main valves. Per cent.
1	120	438.4	17.45	1.0002	.9133	9.5	.....	.....	.....
2	152	483.5	18.66	.7552	.7952	.....	5.3	.....	5.3
3	168	488.4	19.87	.....	.....	.....	.....	.....	.....
4	228	526.5	18.00	.6074	.5773	5.2	.....	5.2	.....
5	200	445.5	19.03	.5681	.5569	2.0	.....	2.0	.....
6	180	401.0	18.73	.55?2	.5569	0.06	.....	0.06	.....
7	216	475.9	18.79	.5976	.5508	8.5	.....	8.5	.....
8	232	500.1	?0.20	.5458	.5387	1.3	.....	1.3	.....
9	240	506.8	20.71	.5221	.5279	.....	1.1	.....	1.1
10	236	?09.2	19.92	.5029	.5419	.....	7.7	.....	7.7
11	188	504.5	18.51	.6822	.6708	1.7	.....	1.7	.....
12	160	460.5	18.29	.7437	.7195	3.3	.....	3.3	.....
13	188	573.0	18.35	.7802	.7619	2.4	.....	2.4	.....
14	104	529.6	18.41	.80?7	.7922	1.3	.....	1.3	.....
15	144	521.3	19.14	.9213	.9051	1.8	.....	1.8	.....
16	184	527.3	19.72	.7093	.7164	.....	1.0	.....	1.0
17	236	470.3	20.33	.5173	.4982	3.9	.....	3.9	.....
18	....	.....	.....	.....	.....	.....	.....	.....	.....
19	....	.....	.....	.....	.....	.....	.....	.....	.....
20	256	512.9	21.01	.5131	.5009	2.4	.....	2.4	.....
21	200	535.9	21.94	.4986	.5153	.....	3.3	.....	3.3
22	268	527.9	21.03	.5076	.4925	3.0	.....	3.0	.....
23	272	557.4	22.44	.4887	.5123	.....	4.8	.....	4.8
24	272	528.7	22.12	.4641	.4860	.....	4.7	.....	4.7
25	268	468.3	22.35	.4378	.4369	0.2	.....	0.2	.....
26	148	367.7	17.98	.6102	.6210	.....	1.7	.....	1.7
27	268	534.0	18.90	.5200	.4982	4.4	.....	4.4	.....

Table "A" is from Mr. Dean's calculations, and it has been checked up and found to be correct. The differences between the horse powers found by the independent set of calculations and those given in Table "A" are very small, and are no doubt due to differences in planimeters. Table "B" gives results of calculations we have made. Fig. 1 shows the average horse power as we have found it. Fig. 2 shows the combined indicator card No. 8, taken at about the average speed. Fig. 3 shows the combined indicator card from a very high grade stationary engine, using steam with the boiler pressure at 120 lbs. per square inch.

It will be seen from this analysis that the average horse power, as we make it, is slightly less than from Mr. Dean's figures, and therefore the water per horse power as given by the tank is higher (see fig. 1). The average water per horse power per hour from the indicator cards we find to be 19.67 lbs., or practically the same as that shown from the tank readings.

This equality throws some doubt upon the results of the tests; that is, the indicated horse power assumed as the average is too high or the water measurement too low, or there was much reheating in the smokebox. If the smokebox was so hot and the reheating so efficient as to re-evaporate all the moisture from the steam entering the high pressure cylinder, then the steam appearing in the low pressure cylinder ought to correspond very nearly with the tank readings, as it does in this case; but when saturated steam is used, as ordinarily is the case, reheating to this extent in the receiver be-

TABLE A—SPEEDS AND POWERS OF COMPOUND LOCOMOTIVE 232, SPECIAL TEST TRAIN, BOSTON TO PROVIDENCE, SUNDAY, MAY 29, 1892, SOUTH BOUND.

No. of card.	High-pressure card scale = 120. Mean heights of indicator cards in hundredths of ins. Left.	Right	Average. Col. 3 + col. 4 / 2	Average mean effective pressure. Col. 5 × 1.3	Revolutions per min.	Horse power. Col. 6 × col. 7 × 0.03751.	Low-pressure card scale = 100. Mean effect. Pressure. Left.	Right.	Average. Col. 9 + col. 10 / 2	Horse power Col. 11 × col. 7 × 0.07469.	Total horse power. Col. 8 + Col. 12.
1.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	14.
1	68.8	63.8	66.30	79.56	120	358.8	43.1	45.7	44.40	394.8	753.6
2	48.3	48 8	48.55	58.26	152	332.4	38.2	40.8	39.50	444.8	777 2
3	36.7	38.3	37.50	45.00	168	281.8	36.3	36 9	36.60	455.6	737.4
4	35.0	38.4	34.20	41.04	228	351.8	30.9	31.1	31.00	523.7	875.0
5	32.0	30.1	31.55	37 26	200	270.7	28.6	28.5	28.55	433.0	702.7
6	33.8	31.5	32.65	39.18	180	264.7	27.7	28.9	28.30	377.4	642.1
7	31.3	31.9	31.60	37.92	216	307.5	28.9	27.6	28.25	452.1	759.6
8	29.5	30.2	29.85	35.82	232	288 8	25.7	26.1	26.40	453.8	742.6
9	26.7	27.0	26.85	32.23	240	290.3	25.7	24.2	24.95	444.6	735.9
10	27.2	28.0	27.60	33.12	236	293.4	27.8	26.5	27.15	477 1	770.5
11	40.6	40.3	40.45	48.54	188	342.6	35.1	33.1	34.10	475.0	817.6
12	45.6	44.0	40.45	52.56	160	315.7	37.3	36.9	37.10	439.8	755.5
13	45.7	46.1	45 90	55.08	188	388.7	38.0	39.8	39.35	548.1	936 8
14	48.7	47.7	48.20	57.84	104	225.8	40.3	40.6	40.45	311.7	537.5
15	53.2	53.6	53.40	64.08	144	346.4	44.7	43.6	44.15	471.0	817.4
16	38.9	40.2	39.55	47.46	184	327.8	34.0	34.7	34.80	474.4	803.2
17	34.7	36.9	25.80	30.96	236	274.3	21.7	23.3	24.00	419.6	693.9
18	.....	.....	.....	.....	.....	No card taken.	.....	.....	.....	.....	.....
19	.....	.....	.....	.....	.....	" "	.....	.....	.....	.....	.....
20	24.7	24.7	24.70	29.64	256	248.8	25.9	25.1	25.50	483.6	732.4
21	23.4	23.1	23.25	27.90	260	272.3	24.0	22.9	23.95	460.4	732.7
22	23.0	22.8	22.90	27.48	268	276.5	24.3	23 7	24 00	476.6	753.1
23	21.9	22.1	22.00	26.40	272	269.6	22.8	24.4	23.60	475.6	745.2
24	20.4	21.3	20.85	25.02	272	255.5	24.0	21.8	23.90	461.5	717.0
25	19.5	19.5	19.50	23.40	268	245.4	20.0	19.6	19.80	383.2	628.6
26	37.9	38.2	38.05	45.66	148	253.7	32.9	32.7	32 80	359.7	613.4
27	27.7	27.6	27.35	32.82	268	330.2	26.1	25.6	26.05	517.2	847.4

Weight of train including engine and tender, 476 tons; weight of train excluding engine and tender, 384 tons; distance, 44 miles; maximum horse power, 936.8; average horse power, 745; feedwater used, including blowing off once, 13,416 lbs.; time developing power, 57½ min. = 0.9583 hour; feedwater used per hour per horse power, 18.791 lbs.

TABLE C—ANALYSIS OF INDICATOR CARD NO. 8.

Volume including clearance. Cu. in.	Absolute pressure. Pounds per sq. in.	Weight of steam in cylinder. Pounds.	Weight of steam used per stroke = A − D and A¹ − D. Pounds.	Per cent. of increase of steam in high pressure cylinder from indicator card No 8.
A.....	111	0.8108	0.5458	
A¹.....	109	0.8130		
D.....	125	0.2641		
D¹.....	127	0.2680		
B.....	21	0.6558	0.5387	1.3
B¹.....	21			
C.....	47	0.1171		
C¹.....	56			

tween the high and low pressure cylinders always so much increases the volume of the steam shown by the low pressure indicator card that the steam used in the low pressure cylinder will appear to be much greater than

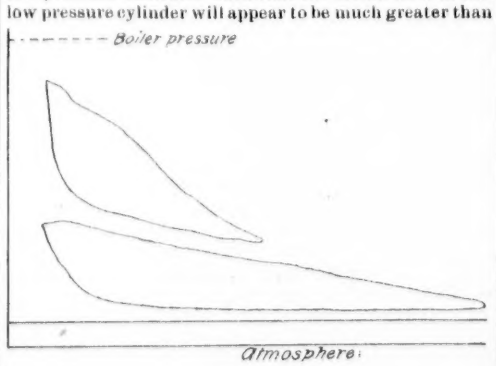

Fig. 2.

that used in the high pressure cylinder. It will be seen from Columns L and M, Table "B" that the steam used in the low pressure cylinder was not materially greater, and generally less, than that used in the high pressure cylinder, and therefore there is no evidence of a substantial reheating in the receiver. That there is no superheating in receivers of two-cylinder compound locomotives (superheating comes after the reheating is carried to a point where all the moisture in the steam is evaporated) has been quite well proved by experiments on the Burlington road made by Mr. William Forsyth, Mechanical Engineer, and Mr. C. H. Quereau, Engineer of Tests. The receiver of Mr. Dean's compound is, however, a peculiar one, and has much more heating surface

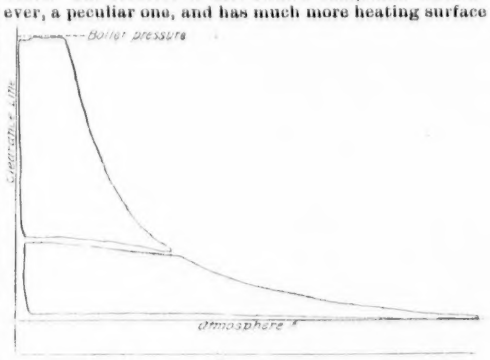

Fig. 3.

than the ordinary receiver. It has ribs and a double passage. This was illustrated in the *Railroad Gazette*, Nov. 25, 1892.

In order to prevent any misunderstanding in this matter we have published an average indicator card, No 8, fig. 5, showing the points at which the steam was measured. The *data* of the calculation are to be found in Table "C." There is always some difficulty in measuring indicator cards for this purpose, as the cards on both ends of the cylinders are generally not the same, and it is necessary to average them. Then, again, cards

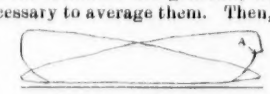

Fig. 4—Card No. 14.

in locomotive tests are sometimes roughly taken; the pencil gets dull, and the lines are somewhat blurred. This was the case with some of these cards. There was evidence that the low pressure main valve lifted during compression. For instance, on card 14 from the low pressure cylinder, given in fig. 4 at the point A, the valve probably lifted, as it has been shown to be the case in other tests where the diagrams have the appearance that this one has. The work in the low pressure cylinder was about one-third more than in the high. On some of the cards there was a double datum line which made the measurement somewhat inaccurate; therefore, the horse power measurements may be taken as more accurate than the measurements of the steam volume that we have made.

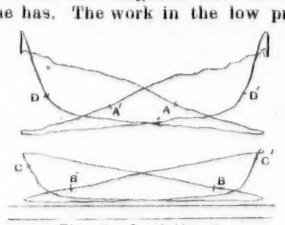

Fig. 5—Card No. 8.

In his letter to the *Railroad Gazette*, Mr. Dean has said that he did not see how his engine could be otherwise than more economical than a single expansion engine under any conditions; but, of course, this was intended to be taken within limits, as will be seen from fig. 6, which shows that the economy of the engine, calculated from the indicator cards, decreases as the revolutions per minute increase beyond about 150. Taking the water as measured by the tank as correct and the average horse power as accurately estimated, we confess

being unable to harmonize the results obtained from this engine with those obtained from compound locomotives of other designs and with the result from stationary compound engines. Although this engine had a steam jacket on the high pressure cylinder, yet this jacket was probably not used during this test, as there was much difficulty in draining it properly; therefore, the steam jackets on the high pressure cylinder and heads may be taken as being high grade non-conducting jackets, but not as reheating jackets.

The cylinders for Mr. Dean's engines were designed so as to lose as little as possible by radiation. Not only are the exhaust and steam passages separated from each other, but they are separated from the walls of the saddles. Mr. Dean endeavored to save the small losses incidental to locomotive work, and undoubtedly the water per horse power per hour from this engine when working under favorable conditions is very low for a locomotive; but generally the difference between the feedwater per horse power per hour and the water

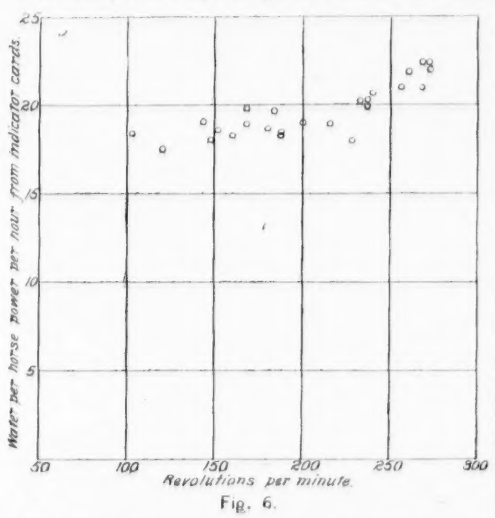

Fig. 6.

shown by the indicator cards varies from 20 to 40 per cent. for locomotives, and we are unable to explain the small difference in the case of Mr. Dean's engine. The length of the run was only 44 miles, and it is difficult to measure the amount of water used with great accuracy during such a short run; perhaps the difference we have been looking for may lie in the water measurements.

The two combined cards, one from Mr. Dean's compound and the other from a high-grade stationary engine, show where the losses occur in the compound locomotive. The card from the high grade pumping engine shows 18 lbs. of water per horse power per hour, and it cannot be expected that a card like fig. 2 would be as economical as the one from a high-grade engine, fig. 3; yet the higher pressure used in the locomotive gives it an advantage in such a comparison as this. A very economical compound locomotive would be one that would give cards like that from the stationary engine, fig. 3, and yet have the higher pressure the same as Mr. Dean's compound.

The Boston Fruit and Produce dealers, with their complaint against the New York, New Haven & Hartford Railroad, bid fair to occupy the attention of the Massachusetts public throughout the "heated term." The legislature decided once that their grievance was not one that could be removed by legislation, but they succeeded in securing the passage of an order requiring the state Railroad Commissioners to take up the matter, and that body has held a hearing. The essence of the question lies in the fact that the New Haven road, bringing perishable (and profitable) freight from the South or West, desires to take it through to Boston by its own line, the Old Colony, while the consignees desire it to come in over the New York & New England, where it formerly came, and where the terminal facilities are more to their liking. It is possible, of course, for a shipper now, as formerly, to order freight handed over to the New York & New England at an established junction, but the New Haven road can easily arrange to make the rates higher and the time slower by such a route. In fact, however, the lawyers have managed to make it appear that the New England is itself responsible for making the rates higher over its own line than over the Old Colony. The curious phase of the controversy is the New Haven's evident nervousness over the possibility of seriously offending the public in Massachusetts, and its intention to yield its position just enough to avoid a big row. When the aggressiveness of the friends of the New England became serious, in the discussion before the legislature, the New Haven expressed a willingness to deliver the freight to the New England at Readville, Mass., but this would give the latter road a very short haul, and was of course objected to. Moreover, the construction of a connecting track at Readville would cost from $6,000 to $20,000. The Railroad Commissioners have now decided that "if any connection is necessary it shall be made at Readville," and have staved off the rest of the matter for the present. The Commissioners evidently see the great difficulty, if not the entire futility, of trying to regulate the matter by a special law or ruling. The traffic is interstate, and the railroad can, if so disposed, contest the jurisdiction of the State Board so as to produce any desired delay. Even if the connection were ordered and built, nothing would be settled about using it, and all the old questions concerning the power of the state to compel two roads to do joint business in a friendly manner would come up for settlement. The New Haven people assert that their Boston terminals are being improved and will soon be as good as the New England's. We do not know how well this will satisfy the fruit dealers; but in any event the road will probably quiet them in some way, so that the legal questions involved will remain in the same interesting state of uncertainty that they are now in.

The killing of eight passengers in a derailment on the Long Island road last Tuesday afternoon is directly attributable to a bad practice in operating, whatever may have been the cause of the accident, although the same practice has been followed on the railroads running between New York and Coney Island for many years. A car in a train running from Sheepshead Bay to Brooklyn was derailed just as the train entered a tunnel near Parkville, and two or three cars were either tipped over upon their sides or dragged along against the masonry lining of the tunnel, and the passengers who were crushed (over 20 were injured, besides those killed) were *riding on the steps* at the sides of the cars. These cars are built like open street cars, with transverse seats the whole width of the car and a longitudinal step the whole length of each side. As in hundreds of cases before, the crowd coming to the station at the close of the afternoon races was allowed to pack the cars to their utmost capacity, and then to fill the steps. Even a street railroad running cars 15 miles an hour would deem this practice dangerous, but the Coney Island roads run these trains at ordinary railroad speeds, say, as high as 40 miles an hour. The exact speed in this case we do not know, though the testimony of the passengers indicates that it was not low. The cause of the derailment is not clear. One intelligent witness says that the engineman shut off steam, and took up the slack very suddenly just as the cars entered the sharp curve leading from the double track to the gauntlet through the tunnel. (It is said that the tunnel was originally built for *two* narrow gauge tracks, but it is not wide enough for two of the trains now used). There is a derailing switch at the fouling point where the accident occurred, and the cabin controlling it is at the further end of the tunnel. It is reported that this switch was thrown under the train, and the signalman has been arrested, but the evidence on this point is not at all clear. If the signalman did make this blunder it will afford one more vivid illustration of the danger of using a derailing switch without a detector bar. But, as already intimated, the fatal fault was the carrying of passengers on the outside of the cars. If the exigencies of a summer railroad forbid the use of inclosed cars and the establishment of suitable platforms and barriers at the stations the plainest prudence dictates the enforcement of very low speed.

A Topeka dispatch says the attorneys of the railroads operating in Kansas have agreed to ignore the Scale law passed by the last legislature, which provides that companies must, by July 1, put in platform (wagon) scales at every station where 100 cars of grain, hay, or other farm products were shipped during the last year. The law fixes a penalty for non-compliance of $100 a day until the scales are put in. No effort will be made to comply with the law. They say that it would cost the companies in Kansas a million dollars. The attorneys decided to go into the courts and test the constitutionality of the law. The lawyers' million estimate is probably rather "steep," as at the liberal price of $400 each, a million dollars would provide a scale at each one of 2,500 stations, or one for every 3½ miles of road in the state; but their argument is doubtless just, nevertheless.* It would probably be easy for the farmers to show that a small percentage on the freight bills on their shipments would pay for the scales in a few years; but the vital point in the case is that the establishment of scales at numerous places where they would be used only twice a week (the minimum of the law) or even twice a day, is a wasteful expenditure for a poor railroad (all the roads of Kansas are poor) as long as other facilities are tolerably sufficient. And they are tolerably sufficient if there are track scales to weigh car-loads at the division termini. A scale set up out of doors, as most or all of these would be, at small stations where only one man is employed, would detoriorate more from the weather and lack of care than from anything else, so that the expenditure for maintenance as well as the first cost would be an uneconomical use of money. If those Kansas farmers were only as anxious to have the roads improve their property in some other respects as they are in those features which come under their own immediate notice there might be some hope of making first class roads in that state after a while.

* The roads reporting to the Kansas State Railroad Commissioners report 3,249 station agents on 24,904 miles of road operated, both in and out of Kansas. If the average in Kansas (8 875 miles of road) is the same as here shown there are only about 1,100 agents in the state, or one to each 7¾ miles of road.

The Great Northern opened its line through to the Pacific Coast for passenger traffic on June 18, as previously announced, and in doing so made a radical reduction in fares. The passenger rates from St. Paul are:

	First class.	Second class.
To Seattle and Puget Sound points	$35	$25
To Spokane	30	23
To Helena and Butte	25	18

The first-class rates named will apply in both directions; the second-class rates on westbound travel only. The through trains have new first and second-class coaches, colonist cars (free berths), dining cars and sleeping cars. The time through, St. Paul to Seattle, is about 75 hours, not greatly different from the Northern Pacific's time to Portland. The sale of tickets to the Pacific Coast over the Canadian Pacific is discontinued at the Eastern offices of the Great Northern. The company has given to the press the following explanation of the reasons for the reduction in rates below the tariffs of the other transcontinental lines:

"On the 5th inst. the lines competing for the Pacific Coast passenger traffic were notified of our dissatisfacton with the conditions under which this traffic was being handled, for the reason that 75 per cent. of the business in both directions was being carried upon a second-class basis, indicating that a large percentage of this second-class business was only so in name. A conference was requested, . . . but was not productive of any satisfactory results. It is not expected, therefore, in inaugurating our through service, that we shall provide a higher basis of rates for first-class travel than has prevailed by the lines of our competitors, and we therefore announce that our basis of first-class rates will be the rate at which travel is carried in tourist cars. . . ."

The reduction in first-class rates to Seattle and other coast points is $25, and in second-class $10. To Spokane the cut in first-class ticket rates is $26.50, second-class $13. The Great Northern Express Company has also made rates on merchandise much below those heretofore in effect. From St. Paul to Dakota and Montana points the reduction is $1.00 per 100 lbs. and to Pacific Coast points $3. The Northern Pacific reduced passenger fares on June 19 to the foregoing figures, and on the 21st announced rates $10 *below* the Great Northern's on first-class and $7 on second-class (through). The Union Pacific has taken no action as yet.

We congratulate our respectable, but somewhat limited, contemporary, *The Engineer*, upon having at last found a correspondent who can see something good in the United States. Its representative at the World's Fair has discovered that even in this vulgar, mercenary and brutally material country there is a good railroad, comfortable in its appointments and skilifully managed, and "that the appearance of the exhibition as a whole is very striking indeed." The gentleman's self-restraint is a little amusing; but still this is a great advance on anything that that journal has permitted to appear in its columns heretofore regarding the World's Fair. Actuated perhaps by its prejudice against all American things, and perhaps somewhat by the fact that its powerful rival, *Engineering*, is so thoroughly committed to the other side, *The Engineer* has never yet recognized that the World's Fair was anything more than a swindling scheme with its place of business situated in a mud-hole. By and by, when really well informed Englishmen begin to return, the editor will learn that he has been belittling the most magnificent of all the World's Fairs that have ever been undertaken, and he will learn then that he has made an enormous mistake as a journalist in doing so; but while that lesson will be wholesome for him, perhaps, it will come too late to do the Fair any good.

The last legislature of New Hampshire passed a law authorizing the Railroad Commissioners of the state to require railroad bridges to be raised where necessary to make the under passage safe for brakemen. It appears that most of the highway bridges over the railroads in the state are too low for safety with the high freight cars that are now common. The new law also applies to through railroad bridges, and it requires that the overhead portion of these bridges and the floors of highway bridges above the tracks be 21 ft. in the clear from the top of the rails. The Railroad Commissioners may grant exceptions. Section 2 of the law prohibits the use of freight cars more than 14 ft. high. The penalty for non-compliance with an order of the Commissioners is $50 a day. The Commissioners have held a hearing, to which all the roads of the state were invited, and have already taken action in one case, that of the Horse Hill bridge, in Concord, which is only 14 ft. 6 in. high. It is ordered raised 4½ ft., and the approaches will have to be raised for a long distance. The Commissioners have authority to apportion to the town or city such part of the cost, outside the railroad location, as they see fit.

The Burlington & Missouri River and the Union Pacific have reduced the train service on a number of branches in Nebraska, chiefly on lines running north from Aurora, Grand Island and Central City. It is said that the Union Pacific will also take off some passenger trains on the Republican Valley lines terminating in Columbus, Stromsburg and Beatrice. Most of these lines have hitherto had one passenger train each way daily, and the reduction consists in taking these off, leaving the whole business to be done by the mixed trains. It is announced that this action is taken in consequence of the general necessity of reducing expenses

and not because Nebraska has passed a law reducing freight rates; but probably the people along the lines will receive this statement with more or less incredulity.

TRADE CATALOGUES.

Catalogue and Steam User's Manual. Star Brass Manufacturing Co., 33 Lancaster St., Boston, Mass.

The publishers have selected a very convenient size, namely, 4 in. × 6½ in., for their catalogue, and have bound it in cloth, and altogether made a handy and durable little book. It shows pressure and vacuum gauges for all purposes, also safety valves, and a general line of steam engine and boiler appliances. Altogether there are 85 pages devoted to illustrations, descriptions and prices of such apparatus. Thirty-three pages are given to useful information for the steam engineer and to a cipher code.

Sparks from the Crescent Anvil. The reader probably knows that a journal with the above title is "published at irregular intervals by the Sales Department of the Crescent Steel Co." The May-November, 1893, issue is an account of the company's exhibit at the World's Fair. The company has gathered specimens of its product showing various grades of steel in various conditions, running from steel forgings to the finest and most beautiful hairspring wire. There is a long list of specimens loaned by customers, including, we should say, at least 125 items. It would be impracticable to give a list of these, but they include dies and cutting tools, drills, punches, reamers and springs from all over the United States. With this list are published letters from the customers of the firm who have sent in samples for exhibition.

Railroad Affairs in Chicago.

Freight.—The grain traffic of the railroads radiating from Chicago to the source of supply suffered a severe shrinkage the past week compared with the preceding one; the aggregate was also much less than for the third week in June last year, and traffic managers expect a moderate business in that line for some weeks hence, unless there is a sharp appreciation in values, as interior holders are unwilling to market their property at the low prices now prevailing. It is well known, however, that there are still large reserves of salable grain. An officer of the Chicago, Burlington & Quincy, who has just returned from a trip taken for the purpose of collecting information in regard to supplies, reports that over 4,000,000 bushels of corn along the line of the road in Illinois will come forward as soon as prices advance to reasonable figures. This, however, is only a moderate percentage of the marketable corn along the system. Oats are in nearly as large supply, and there are fair stocks of other grain. Officials of other roads traversing the grain belt make similar statements as to salable stocks along their lines, and their statements are sustained by advices received by dealers here and interior merchants who were here from all parts of the country last week.

Cattle are also reported to be more abundant than a year ago, but hogs less plenty, and that class of traffic will be light through the summer. The movement of miscellaneous freight from the country continues much heavier than a year since; there is also a liberal outward business in merchandise and mixed freight, and as the majority consists of shipments to points along the lines of the roads with which they originated the business is the most profitable class handled.

Passenger Traffic.—The boom started in the passenger traffic a fortnight since increases daily. The number of passengers carried the week ending the 17th exceeded any equal number of days, and the officers of some of the roads state that their passenger equipment is well employed. The General Manager of the Chicago, Milwaukee & St. Paul stated that he thought the passenger equipment of his line was equal, if not superior, to that of any other road centring here, but should travel increase as largely the coming week as it did the one ending June 17, every passenger car would be in commission, and run crowded.

General Manager Merrill, of the Burlington system, stated that 70 per cent. of his cars were already in service, and he felt sure that the remaining 30 per cent. would be employed before July. General Manager St. John, of the Chicago, Rock Island & Pacific, stated that he had very few idle cars or engines, and that at the rate travel over his road was increasing his entire outfit would be required ere the 25th instant. The weekly earning statements of many of the roads also show that the percentage of passenger receipts is closely approaching to that for freight. Such figures mean profit. The enlarged passenger business warrants the heavy expenditures made for rolling stock in anticipation of the business it was expected would be attracted here when the World's Fair opened. It also furnishes ample justification for the action of the officers in declining to reduce passenger rates to a non-paying basis at the commands of the newspapers and others who imagined that the railroads should bring passengers here at a nominal figure as an encouragement for them to visit the Fair.

Earnings.—In addition to the flattering earning statements of the majority of the Chicago railroads the promptness with which they are paying for materials is evidence of their prosperity. The treasurer of one of the largest railroad supply establishments in the country says that although the roads are conservative in buying supplies, and unusually tenacious in contending for low prices, they pay with surprising promptness. Another person referring to the same subject said: "A number of the old roads have adopted the cash principle in buying. They know manufacturers of railroad goods are needing money, and they pay spot cash for goods and demand a discount on their bills." Speaking of this new departure the general manager of one of the roads said: "We have the money on hand and are anxious that it should earn the most interest possible, hence we cash our bills and get the discount just as a wise merchant who has ready money is accustomed to do. The cash system is also a check on careless purchasing, as we are less liable to buy in anticipation of possible wants provided we know that we must at once check for the money."

Advices regarding the growing crops are encouraging. With the exception of winter wheat, all grain promises a much larger yield than last year; the acreage is also greater. Grass and other crops are equally promising, and unless an adverse change occurs in the agricultural situation, the business year commencing with July will give the Western railroads a larger volume of traffic than ever handled in any corresponding time.

For the purpose of increasing traveling facilities between Chicago and southern Texas the Burlington has put on a regular through passenger train to San Antonio. The train will be continued until the close of the World's Fair, and if business justifies, the service will be continued. The Rock Island officials also expect to open their new line to Ft. Worth July 15, when they will run one solid train through daily.

Flour and Grain.—The receipts of flour and grain at Chicago by 11 leading Western railroads the week ending June 17 and same time the preceding year were as follows:

	1893.		1892.	
	Flour.	Grain.	Flour.	Grain.
C. N. W.	13,732	708,000	17,520	316.000
Ill. Cent.	1,350	508,000	.....	371,000
C., R. I. & P.	6,300	707,000	3,875	912,000
C., B. & Q.	7,231	766,000	11,408	1,426,000
C. & Alton	450	105,000	7,925	173.000
C. E. Ill.	150	55,000	.....	62 000
C., M. & St. P.	18,006	477,000	25,925	1,058.000
Wabash	300	165,000	1,710	137,000
C., Gt. W.	10,803	115,000	39,955	294,000
A., T. & S. Fe.	4,360	154,000	140	402,000
Wis. Cent.	594	.....	1,750	....
Total	63,270	3,761.000	110,208	5,151,000

It will be seen that the North Western, Illinois Central, and Chicago & Alton increased their grain traffic while the Chicago, Burlington & Quincy, Rock Island, Atchison, Topeka & Santa Fe., Chicago, Milwaukee & St. Paul, and Chicago & Great Western lost. The heavy decrease on flour is attributed to the low rates made to the seaboard by the "Soo" line from Minneapolis, which is the main shipping point for flour. Officers of Chicago roads also say they doubt any improvement in that traffic, as it is the chief reliance of the "Soo" and it will keep rates lower than they can make and get anything for hauling.

CHICAGO, June 19.

Master Mechanics' Convention.

The twenty-sixth annual convention of the American Railway Master Mechanics' Association opened at Lakewood last Tuesday morning.

President Hickey delivered an address which we are obliged to condense to very small compass notwithstanding its merits.

He spoke particularly of the labor problem as one that is now causing great anxiety to all employers, and urged his hearers to remember that it was in their power to do much for peace and harmony. It should be their aim to use justice and to deal with the men in a spirit of conciliation, and to meet reasonable demands with candor and fairness.

He next spoke of some of the elements of economy in motive power. Under ordinary conditions, with simple engines, we are exhausting steam containing nearly 50 per cent. of its original value. Efforts to better this by improved valve motion have had little success. Increasing the capacity of boilers and improving methods of combustion, thus reducing the velocity of the heated currents, must be followed by satisfactory results, and another means of economy is the introduction of the compound principle. The experience has been such as to warrant great hope of economy by the use of compound engines where properly designed.

The cost of repairs reaches nearly 4¾ cents per engine mile as an average of the largest roads, and the maintenance of boilers contributes largely to this, and it is one of the most improtant duties of the Association to ascertain the most durable material. The design and handling of boilers should also be a matter of special attention.

Increased bearing surface for all parts subject to wear should also be carefully considered as one of the elements of economy in maintenance. So of the matter of eliminating straps, keys and bolts from connecting and parallel rods, and of improved construction of driving boxes. It would be easy to design a box that would give double the mileage of that in ordinary service.

The dimensions of details should be based upon a tonnage rating of engines. It would be practicable to devise a means of measuring the actual pull on the drawbar, and the maximum power of an engine being thus established, train loads for the district in which it runs would be fixed.

Mr. Hickey then spoke of the great possibilities for technical education among the youth of our land, and said that it seemed to him a plain duty of intelligent employers to aid in the spread of education by refusing to employ any who were not possessed of a reasonably fair education. Efficiency is in direct proportion to the education and intelligence of employes.

He called the attention of the Association to the necessity of having a standing advisory committee to advise with and consult members on disturbing and unsettled questions, and to arbitrate differences between persons selling or renting rolling stock and others arising in the construction of machinery. In other words, an advisory and arbitrating committee.

The report of the Secretary showed a net gain of 41 members, there being now 515 active, 15 associate and 18 honorary members; total, 548. The report alluded by name to the members who had died during the year, four in all. The collections during the year amounted to $2,747, of this $865 having been contributions to the printing fund. These contributions are declining, because of the consolidation of railroads. The Stevens scholarships are now held by a son of Mr. Hodgman in the Institute, and by a son of Mr. A. J. Cromwell and a son of Mr. J, D. McIlwaine in the preparatory school. There is still one vacancy.

A communication was read from the Master Car & Locomotive Painters' Association, asking the support of the Master Mechanics, but the communication did not state definitely what was wanted.

Mr. Barnes moved that the Secretary be instructed to report at the next convention a suitable size for the published proceedings, the report to be made after conference with the M. C. B. Association. The motion was referred to the Executive Committee for action.

Messrs. J. H. Leeds and Harry P. Robinson were elected associate members.

MORNING SESSION, TUESDAY, JUNE 19.

The Committee on Exhaust Nozzles and Steam Passages made no report. The committee was discharged and the subject continued.

The report of the Committee on Standard Tests for Locomotives was accepted only as a preliminary report and ordered to be received without reading. Discussion of the report is the first order for Wednesday morning.

TOPICAL DISCUSSIONS.

Question by Mr. J. Davis Barnett: "Should the fluting on the side rods be done at the forge under the steam hammer, or in machine shop on the planing machine?"

Mr. Barnett: Undoubtedly you can manufacture rods more cheaply by forging the flutes, and if the milling machines and planing machines should be fairly well occupied with other work it is sometimes a clear gain to do that work by hammer. Does any one know if a fluted rod is stronger by reason of being left with the skin on it? If the rod is machined and left bright, does its treatment tend to show any defects that might be in the rods?

Mr. Vauclain: We make about 35,000,000 lbs. of forgings a year, and I think that a forging to size is not stronger than one made above size and finished. The use of steel axles has brought out the specification that the axle must be turned all over to determine any slight surface defects, and to make them of uniform section so as to thoroughly distribute the strains. A fluted rod when made of I section should be of uniform section unless the section can be increased in the centre; the depth of the rod might be increased in the centre. It is not cheaper to forge a fluted rod on a hammer in a smith's shop than to finish on milling machines. The least variation in the blow will make a variation in the thickness of the rod, and you are liable to drive splinters or other defects into the surface of the rod which are concealed by the skin. Fluted rods should be milled on a milling machine so that we may be sure that no defects exist.

Mr. Dean—The prevailing idea that the skin of a forging is stronger than the inside is erroneous.

Mr. D. L. Barnes—This depends on the size of the hammer. If it is a light hammer the skin of the material is very much more dense. If it is a heavy hammer the effect is very much the same throughout.

Mr. Vauclain—My own opinion is that the skin of a forging is weaker than the interior on account of its being full of slight indentations. It is desirable to have a proper amount of work put on the steel before it is used for forging. We found that to obtain a uniform quality it was necessary to make our specification read: A test piece cut from the billet must have a certain tensile strength and certain elongation. This necessitated the casting of larger ingots and the work being put on them in the steel mill before the billet was sold to us.

Mr. Forsyth— We have been forging rods of steel and scrap iron at our Burlington shops quite awhile, not because we think that such a rod is better, but as a matter of economy, and we use them only on freight and second-class engines.

Mr. Henderson—Does not cutting from billet consume a great deal of material?

Mr. Vauclain—It does, but we know what we are doing. By the other practice we consumed very little material but we knew nothing. We had steel blooms that had high tensile strength, and the elongation was not much over 5 per cent. But now we are able to meet any specification.

Mr. Barnett—I have finished rods from the one die, but a handsomer piece of work can be turned out by the use of two dies. I am proud of the work turned out from one set of dies. It is difficult to find a forge man who will forge a fluted rod, but after a little practice the result is eminently satisfactory with one pair of dies.

Mr. Leeds—A forging that is worked up true and nice will stand more strain than one that is full of dents. Forging the ends and turning the grain around the boss gives a stronger job than to take a flat piece and slot it around. I have found that where we forge a square corner we have fine cracks, and if the corner is machined off it leaves solid material. If we undertake to work it down by forging we have covered cracks that exist. There is little preference in the strength of a machined rod or a forged rod except perhaps in the stub ends from turning the grain around the boss.

Mr. Mitchell—We flat all our rods on a milling machine. We use entirely steel rods finished.

Mr. Lewis—I agree with Mr. Vauclain about value of the skin of the metal. The machining will remove all surface cracks, and I think that rods should be finished on all surfaces.

Mr. Potter—It is our practice to finish fluted rods on the machine; it is necessary to remove small cracks that exist and which would be a starting point for a fracture. Our fluted rods are all of steel.

Mr. Barnett—I have no experience in steel; we make rods out of wrought scrap.

Mr. Setchel—In order to equalize strains that are unavoidable in a forging it is necessary that the surfaces should be finished. Steel tires are full of cracks that form the starting point for a break, and I believe in turning all tires.

Mr. Smith—I can make rods cheaper under a die than with the milling machines we have in our shop.

Mr. Vauclain—Fluted rods can be made at our works for about 25 per cent. of what it would cost to make them under the hammer. If we had an experienced hammer man, and he should stay out, we would have to wait until he came back to get some more fluted rods. But if we do the work by a milling machine we not only get it done better, but if the milling man goes out we put on another man to run the machine. We believe that the day of the blacksmith's shop has passed, and that the mechanic is going to be the blacksmith. Some seven years ago we had about four acres of blacksmith shop, and we built ten locomotives per week of very light weight, compared with the locomotives that we build now. While at the present time we have two acres of blacksmith shop and we build 20 locomotives per week.

Mr. Dean—I had my attention called recently to a machine made by the Pratt & Whitney Company that revolutionizes practice in one respect. The old way has been to run the milling machine so that the cutting edge moves in the opposite direction to the movement of the rod. But they now make the machine so that the cutting edge moves in the same direction, so that the action of the milling machine is to pull the rod under, and the success of that method, they inform me, depends on the weight of the machine.

BROKEN CYLINDERS AND FRAMES IN CONSOLIDATION ENGINES.

Mr. Gentry proposed the question: "Has any member using heavy consolidation engines had trouble with broken cylinders and frames, also cylinders getting loose, etc.?" He referred particularly to consolidation engines with fireboxes on top of the frames, necessitating very long saddles, having had considerable trouble from cylinders breaking off at the saddle next to the frame.

Mr. David Brown—We have had passenger cylinders break in that way, and we have put a brace at the back and in front of the cylinder, and have run them quite a long time. We attributed it more to the thickness of the walls. When we put new cylinders on we made the walls thicker, and we did not have further trouble. Engines that have boilers on top of the frames have a tendency to swing a little more and have given us trouble, but by bracing them with a cross brace back and front we seem to have overcome the trouble.

Mr. Mitchell—We have had trouble of this kind, and stopped it to a great extent by increasing the walls of the cylinders and at the same time putting a brace between the upper and lower bar of each frame, just back of the cylinder. In some instances we have put a yoke right around the upper and lower bar of each frame both fore and aft of the cylinder.

Mr. McNaughton—We have overcome the difficulty by bracing the cylinders back and forward, and in some cases taking the flange off the saddles both forward and back and tying both the cylinders together with a plain plate. The trouble was due to the faulty design, and in making the new patterns we have thickened the walls and hope to stop the trouble. We have had some experience with cylinders getting loose on mogul engines, particularly in the saddles. We have done nothing to them except to reinforce the smokebox with heavier plates and bolts.

Capt. Wade—Consolidation engines with low wheels are not the type for fast speed. Compressing and bad counterbalancing cause great strains on cylinders and frames, and that, in my opinion, is what causes breakage.

Mr. Boon—The starting point is bad workmanship. Almost invariably when the cylinder works loose on the frame it will be found on examination that the bolts originally put in were not a good fit. We are throwing up the centre of the boiler, and the strain on these cylinders, carrying from 150 to 180 lbs. pressure, is terrible. The only way to stop frames from breakage and cylinders from getting lose is to make them right at the start.

Mr. Gentry—We have had 15 cases of broken piston rods in less than as many months, and I have noted that 11 of those 15 rods broke on the left side and only four on the right side. A large majority of them broke between the shoulder and the key-slot; some right at the shoulder, some in the key-slot. Out of 23 cases of cracked and broken cylinders 18 are on the left side. Our engines lead right-handed.

Mr. McIntosh—We have had loose cylinders, but we attribute the difficulty to bolts being improperly put in and to poor workmanship. We find when they are re-keyed and new bolts put in that the trouble ceases.

Mr. Brown—The way to keep the piston rods from breaking is to examine them occasionally. We have adopted a system of taking them out occasionally and looking at them. We have very few broken rods. We make a very close inspection of the piston rods, especially around the shoulders and the keyways, as well as the heads. I find that if we run an engine about ten months or a year, with the service that we get on our road, there is certainly a flaw around the hole or in the shoulder.

Mr. Smith—We examine piston rods about every two months. We have had more difficulty with steel than with wrought iron rods. We have partly abandoned the steel rod and gone to iron.

Mr. McNaughton—I have tried both, and get the best results from steel.

Mr. Setchel—Does Mr. Gentry attribute the breaking of his rods to the Laird guide?

Mr. Gentry—We have not attributed it to anything in particular. The cylinders we are putting in ourselves are not breaking. We have a better disposition of the metal, and I think we have done a better job in reaming and bolting.

Mr. Pomeroy—Mr. Smart, of the Michigan Central, has said that crossheads only 18 inches long with the Laird guide had given a great deal of trouble, but since he had made them 20 inches he had not broken a single rod.

Mr. Smith—We find about as many broken piston rods with the 4-bar guide as with the Laird guide.

Mr. Vauclain—The reason for broken piston rods is that the crossheads are allowed to go with considerable play, and play is more liable to give trouble with the Laird guide than with any other.

Mr. Gentry—Our rods are so made that they draw against the shoulder, and we do not use the key for drawing them there. Our keys go one from the bottom and one from the top. We drive the piston rod home and key it up with temporary keys, and then drive the keys in as they are to remain.

Mr. Potter—In nearly every case where the piston rod has broken it has shown indications of having been loose at the larger end of the taper. The key holds the small end rigidly, and if it becomes loose at the larger end there is a vibration that is liable to cause it to break. It has been suggested that this difficulty might be overcome by making a taper to the crosshead fit and doing away with the shoulder altogether, so that if that end of the rod did become somewhat loosened in size, by removing it and replacing it it could be drawn in and the fit maintained throughout.

Mr. Mackenzie—I think that we have had more piston rods broken in proportion to the number of engines than any other railroad in America. I attribute the whole matter to defect in mechanical construction, the piston fit in the crosshead being too small in every case. Our practice is, and we find it to work very well, to increase the size of the diameter of both the piston fit and the crosshead fit and make it just a small diameter below the size of the rod itself. We find that with our packing it is not necessary to turn piston rods; and when we run them so long that previously we would turn them, we now throw them away. By increasing the fit ½-inch nearly throughout we have about done away with broken piston rods. The Laird guide gives trouble, and we have some double-bar guides and we have had no trouble with a broken piston rod.

Mr. Roberts—We attributed our trouble with broken piston rods at first to corners in the key seat. We remedied that and found that rods would break in the centre of the keyway. We have a number of freight engines with Laird guides and have never had one break. The breakages have always been with passenger engines with the 4-bar guide. They are steel piston rods, and we attribute breakages to the reasons mentioned rather to short bearings of crossheads. I believe a good deal of this trouble could be eliminated by going back to the old practice of grinding piston rods into our crossheads. We have now taken up iron rods to see if the results will be better.

REPORT ON TESTS OF IRON AND STEEL.

A series of observations have been made on firebox steel that has been in service as long as 18 years down to steel that has failed by cracking in less than six months' service. It is almost impossible to reproduce the various phenomena observed in the fracture of these pieces so as to embody the same in this report. No adequate idea can be presented except by an actual inspection of the broken pieces.

The sample pieces were cut out to a size 7×3 ins., and punched on the sides, so that the fractured surface was 1½ ins. long.

These pieces were then broken by bending alternately forward and backward, to an angle of about 33 deg. from the plane of the piece. In a number of cases the sample was nicked slightly, and the nicked samples seemed to produce a fracture that would give a better idea of the characteristics of the steel than those which were not nicked. The more frequent bending of the samples not nicked so affected the appearance of the fracture that little could be determined therefrom. The same trouble is experienced in observing the fracture of a piece subjected to a tensile test on the machine. In such pieces no idea can be formed of the character of the crystallization, and but a slight idea of the tendency to lamination. In the bending test, if the samples are nicked, a very clear idea of the crystallization is attained, and frequently of the amount of lamination. When the samples were not nickel, the character of the crystallization was much affected in breaking, but the presence of lamination was made very apparent. It is, therefore, the opinion of your committee, that in addition to the usual tensile test, the samples of steel should be subjected to a bending test until fracture occurs, and that this test should be made on both nicked and unnicked pieces.

In nearly every piece subjected to the bending test, more or less lamination was observed. Some of these laminations were less than an eighth of an inch in width, and looked as if they were caused by minute bubbles of gas, and they varied in size from this to a size extending almost across the fracture. These laminations were decidedly less apparent in the steel which had been long in service, although a slight lamination was observed in the piece longest in service. Your committee are inclined to believe that an idea of the durability of steel can be formed from the amount of lamination observed, and that the most durable steel will be freest from the same, but it is not yet quite prepared to take a decided stand on this point. They would recommend, however, that this method of test be added to the usual tensile test by the members of this Association, and that results be carefully watched to verify or controvert the position taken.

Undoubtedly steel-makers, by observation on this point, could throw considerable light on the subject. The following questions naturally arise: Is the presence or absence of lamination due to manipulation on the part of the steel-maker, or to the character of the raw material used? Can lamination be avoided by manipulation of the molten metal? Can it be avoided by discarding a larger portion of the top of the ingot? Is not the tendency to cheapen production largely responsible for the apparent increase in lamination in steels of later manufacture?

Steel-makers could undoubtedly throw considerable light on this subject if they are willing to do so, but your committee feel utterly at a loss to give answers that would be of any value. At the same time they are fully convinced that the present specifications requiring a certain chemical composition of the steel, and a certain tensile strength and elongation, are not sufficient to insure satisfactory results, so far as durability of steel for firebox purposes is concerned.

In addition to the phenomena of lamination, there is a very great difference in the color and character of the crystallization displayed in the surfaces of fractures of the different samples, as well as sharpness of the same to the touch. The character of crystallization can undoubtedly be very much modified by the manner of cooling, and therefore in making observations on crystallization it would seem that the pieces should be subjected to uniform treatment as to heating and cooling before being broken. It is the opinion of your committee that deductions as to the quality of steels can be made with great accuracy from the general character of the crystallization, but that to do so a large amount of prior observation and experience will be required. It is well known that all large business houses buy simply on expert inspection without attempting anything in the way of specifications. Railroads, on the contrary, buy all their steel on chemical and physical specifications, and, as far as your committee know, entirely ignore the question of expert inspection. In fact, it would be difficult to find to-day, on any railroad, an expert employed as such who would undertake to grade a lot of 20 samples of steel, running from good tool steel to the cheapest products, in accordance with their prices and qualities; while at the same time there is good reason for believing that with proper training such grading could be very accurately done. This method of grading is practiced in almost every line of trade.

Your committee are decidedly of the opinion that certain requirements as to chemical composition, tensile strength and elongation, do not insure the best quality of steel for firebox work. It is not certain that further inspection as to character of crystallization, etc., will do so, but there are good reasons for believing that such inspection would be of material benefit if made by an expert.

It is not intended that this system of inspection should dispense with present chemical and physical specifications; these have been made, or at least should have been made, from analyses and tests of steel that have given good results in actual service, but necessarily ignore much that is due to manipulation, and it is the importance of the points ignored on which your committee dwell.

Committee { WM. SMITH, J. N BARR, A. W. QUACKENBUSH, P. H. PECK, D. L. BARNES.

AFTERNOON SESSION.

The Discussion of the Report of the Committee on Tests of Iron and Steel.

Permission was granted to Mr. Barnes to submit the following remarks as a minority report:

Mr. Barnes—I am decidedly in favor of specifications for steel. It is my belief that when the steel gives a proper chemical analysis and a proper physical test and is made according to well known processes for making steel, it will be a good material for fireboxes.

We know a good deal about chemical analysis. Physical tests, including bending tests, are well known, and so well described in technical literature that it is not worth while to describe them here. To make good steel is quite a difficult matter. It is true that a railroad expert ought to know much about the manufacture of steel, and if he cares to do so it is very easy for him to learn about it. If the bottom of an ingot that has been properly or reasonably well cast is cut off and then hammered well and cross-rolled to the width of the sheet, and then lengthwise rolled to the length of the sheet or down to the proper thickness, the result will be a good sheet of steel, perfectly safe for fireboxes, provided the chemical and physical tests show the material to be what is wanted otherwise. That is the plan which is followed in this country for government work of the very highest grade, and for all boiler steel made in Europe. I think that this statement is more in keeping with the present condition of steel manufacture than the report.

I recently had 45 engines built for a road under specification; and after making the most rigid specification that I could make to conform to the best practice of the United States Government, I asked the steelmakers to guarantee the fireboxes against laminations for five years. Several bidders on those specifications accepted that condition. They did not make the steel, perhaps, in the way that they ordinarily would, but they can make good steel if they agree to do so.

Mr. Vauclain—When you get away from the scientific inspection of boiler plate you are losing ground. I find that in handling boiler plate the principal difficulty to overcome is lamination. I cannot detect it until I first put it in the fire. I think, as Mr. Barnes has said, that the proper way to get good steel is to make our specification right and live up to it.

Mr. Smith—There is no specification you can get out that steelmakers cannot get around. Out of 25 samples that were broken up and gone through, you scarcely could find two alike. I am under the impression that I can tell more from a tensile test and then a fracture than in any other way. If you go to the scrap pile you can find out more about steel there than in the laboratory, I think.

Mr. Swanston—Granting that both the physical and chemical tests are essential and good, is it not a fact that a steel meeting all those specifications may yet not do its work in the firebox? I have a good many instances of that kind. On one division I cannot keep a firebox over an average of two years. We have had steel that met the specifications and failed entirely inside of nine months.

Mr. Barnes—The specifications were, perhaps, unfortunate.

Mr. Mackenzie—Does Mr. Swanston find this failure more with the steel of one manufacturer than with the steel of another?

Mr. Swanston—Recently I think it is about the same in all of them. Some years ago I asked for Otis steel, and got about ten or twelve fireboxes, and they were no better than the others.

Mr. Smith—The trouble on our road is not so much lamination as cracking of the sheets. Some of them crack inside of six months.

Mr. Forsyth—I am very much surprised at the tone of this report. It states "that your Committee are decidedly of the opinion that certain requirements as to chemical composition and tensile strength do not insure the best qualities of steel for firebox work." The Committee go on to explain what they think is the best way to insure that, and so far as I can get the idea it is that you are to train up an expert by the examination of scrap piles and crystallized fractures until you have got a man who can tell by the sight of these fractures whether the steel is good or not. Now, I submit whether this is a practical thing to offer to consumers of steel plate as a substitute for chemical analysis and tensile tests. We have been buying steel to physical test for about 15 years, and we have comparatively few cracked plates. I think this trouble with cracked plates is a local one, and it seems to have broken out in rather a virulent shape on the Northwestern road, and I should say that it is certainly due rather to the construction of the boiler, or the manipulation of the sheets or the treatment of the firebox, than the quality of the steel.

Mr. Leeds—About eleven years ago I got 16 engines, with three different kinds of steel. I had pieces taken from them and had chemical analysis and physical tests made, as I also did of another very high grade steel. The engines were put in service under almost exactly the same condition. In fact, during part of the time they were interchanged from one division to another, and after running eight years there were eight that had not shown a blister or a crack, and apparently were as perfect as the day they were put in. Every one of the other four had a crack on each side of the firebox. I then drew up specifications that were an average of four manufacturers, but I was told that I was altogether too rigid. I had pieces cut from fireboxes that were perfect and had them analyzed, and, contrary to all assertions made by steel manufacturers, we found that the sulphur had increased materially in the whole of them, and that the steel was harder than the sample taken from the new steel when put in the boilers, and it showed a shorter or more crystalline fracture. I have made up my mind that there is a great deal in the raw material used, and while insisting that our manufacturers should apply every chemical and physical test, at the same time if we could buy our steel as we buy our wheels, under a guarantee, and put the responsibility on the manufacturer and let him depend on his chemistry, it would be a great deal better than for us to lay down cast-iron rules—that he shall make a steel that shall fill certain requirements.

Mr. Barnes—I know of one or two locomotive builders who are building locomotive boilers and giving a guarantee for their performance, provided they are allowed to put in such material as they think best, allowed to make their own boiler designs, and if the railroad will agree to wash them out with hot water.

Mr. Blackwell—What the firm that I represent consider most dangerous in steel for firebox purposes are phosphorus and sulphur. They also consider that lamination is a very serious detriment to firebox steel, and that a strictly homogeneous steel is the perfect steel for firebox purposes. Any steel maker is apt occasionally to have a bad sheet go out. A test piece may be cut off the edge of the sheet which was rolled off the good part of the ingot and may show good results. If that sheet is cut up into half a dozen smaller ones, one or more of those sheets may fail, because they were rolled from the top part of the ingot. It is really difficult for a manufacturer to say positively that every sheet that goes out of his mill is absolutely first-class.

Mr. Barnes—How would Mr. Blackwell pick out from his yard a first-class piece of firebox steel?

Mr. Blackwell—I would make a chemical and physical examination of the sheet. I would examine for the different elements—carbon, phosphorus, silicon, manganese and so on, and I should pull it to see the tensile strenght and elongation, and I should nick it and see if I could discover any lamination. The great trouble about the nicking test is that you have a test piece that shows no sign of lamination, and right alongside of that you may have a lamination extending 12, 24 or 30 square inches in area. You may have bad lamination in the test piece and hardly any in the sheet, and vice versa.

Mr. Henderson—While the examination of pieces after they are taken out of the firebox will undoubtedly give a very good idea of the kind of steel, I believe that those tests, if taken before the sheet was put in the box, would give a very different fracture, and I doubt if you could judge by the fracture you would get after a firebox has been in service five years what sort of a fracture you would have obtained beforehand.

Mr. Leeds—With reference to my former statement, I would state that there was no variation in the analysis after eight years' service with the exception of sulphur and a slight variation in phosphorus.

Mr. Blackwell—I do not think it is proper to compare, as is sometimes done, the service of the firebox of the present day by years with fireboxes of former years. We now double or treble the mileage per month of the engine over what it was ten or fifteen years ago, and we are using 160 to 180 and 200 lbs. pressure and have much higher firebox temperature.

Mr. McIntosh—If a better quality of steel can be made by steel makers at double the price we are paying for it now it would pay the railroad companies to buy it, for the reason that the steel which goes into the firebox represents but a small per cent. of the cost of renewing the firebox.

Mr. Smith—Since last year three proprietors of steel mills in this country have told me personally that they are not making the best steel; they were not getting the price for it. One steel maker told me that he would require 5½ cents a pound to make first-class steel. Now, if such is the case, what is the use of our specifications either chemical or physical?

Mr. Vauclain—I think either 3, 3½ or 4 or 5½ cents per lb. would not only enable the manufacturer to make good steel, but it would also enable him to make a very large fortune in a very short time. You can put the best Scotch steel on the wharf in this country for a great deal less money than the ordinary selling price of steel in this country to-day. When you come to talk about 3 cents and 4 cents and 4½ cents and 5 cents and 5½ cents for steel, there is no reason for those prices at all. I think that steel manufacturers can manufacture a good steel to any specification and guarantee it for the very lowest price now paid for steel.

Mr. Smith—I would ask Mr. Vauclain how long they would guarantee steel?

Mr. Vauclain—We have guaranteed fireboxes for five years. We take it for granted that five years would be the average life of a firebox where engines are used continuously as they are to-day.

Mr. Barnes—I was on the committee last year, and we devoted much time to find out what caused lamination, and we could not find one cause that did not rest with the steel makers themselves, and I know the decision was, in some discussion I had with steel makers, that they could not tell me how I could determine when a sheet was laminated in the middle. If it was laminated in the edge I could find it. The laminations mostly come from improper pouring of the ingot. It may have gas bubbles which will make small or local laminations. There may be a chill on one side, or in hammering the ingot under the hammer one blow may be stronger than another and make a shoulder. In rolling, this shoulder rolls out as a film over the plate. Therefore, when making a specification I had the makers of the steel agree not only to furnish new steel, but to put in the new fireboxes and pay all the expenses of putting in in case of failure. This is, of course, something unusual, and the cost of labor is by far the greater part of the total cost of renewing fireboxes. The fireboxes put in under guarantee have not shown any lamination so far, and the fires have been so hot that if there had been any lamination they would have shown up.

Mr. McIntosh—Ninety per cent. of the failures are from cracking, and not lamination.

Mr. Sinclair—I think steel makers could well afford to guarantee sheets for 20 years against lamination.

Mr. Blackwell—I would like to ask Mr. Barnes how he expects the lamination to show itself in the firebox?

Mr. Barnes—By a blister, which leads to a crack.

Mr. Blackwell—I think there may be very serious laminations in sheets and they will not show in the shape of blisters unless the lamination is very near the surface.

Mr. Gentry—Our trouble is almost exclusively from cracks not at any one spot; sometimes the side sheet, sometimes the back sheet, sometimes the throat sheet. We have had more in the back sheet near the door than anywhere else. We have not had any laminated fireboxes yet.

Mr. Brown—We find that engines that have light work to do give very little trouble with their fireboxes. On switching engines we have fireboxes that have been running since 1876. Again we have had passenger engines, before we widened the firebox over the frames in which we put the third firebox in in five years. This was the result of the hard work the engine had to do. Since then we have gone into the Wootten firebox, and have not had much trouble with lamination.

SECOND SESSION, TUESDAY.

The Committee on Compound Locomotives submitted its report, which was received.

RRPORT ON COMPOUND LOCOMOTIVES.

As to the substantial advance made in the introduction of compounds since the last report the statements received from locomotive builders in this country show good progress, as follows:

COMPOUND LOCOMOTIVES IN USE IN AMERICA.

Builders.	June, 1892.	June, 1893.
Baldwin Locomotive Works	65	316
Schenectady Locomotive Works	35	69
Rhode Island Locomotive Works	14	37
Others	?	?
Totals	114	422

In addition to above, reports show 1,088 compounds under construction and 75 of American manufacture in use in foreign countries.

An inspection of the geographical distribution of these locomotives reveals the fact that the great majority are running upon roads where coal is cheap, so that their approval upon those roads means satisfactory possibilities for our Western Master Mechanics, who have to contend with dear fuel.

Before entering upon a discussion of the problem, your committee beg to present all the information they have been able to collect in the nature of tests or figures. This is embodied in the following:

Synopsis of Information Obtained from Railroad Companies.

The following information is abstracted from answers received by your committee to a circular sent to various members of this Association. The circular requested, particularly, practical data bearing upon experience with compound locomotives in actual service. It was stated that your committee hoped in this way to obtain information which would shed some light upon the probable net value of compounding locomotives. They further desired "to bring out as fully as possible the advantages as well as the defects of compound locomotives, not only as regards fuel economy, but as to all other elements which go to make up a successful machine, from an operating as well as a motive-power point of view. Quite a large number of replies were received, in the majority of which members were obliged to state that they had had no experience with compounds; in others, information given was so meagre that no conclusions were deducible at a distance. Your committee also reported absence of replies from some of our members who are known to have a considerable number of compounds in use. The following are abstracts from those giving fullest information, with comments upon the results. Your committee hope that unwarrantable deductions will be corrected by members present representing the roads quoted, for in no case was it possible for the circulars to cover a statement of all local conditions governing the tests:

Northern Pacific Railroad.

Performance sheets record of five month's service in freight with one compound and one simple Baldwin mogul.

Engines of same dimensions, the compound having 20 lbs. higher steam pressure. Engines in service two years, having run about 60,000 miles. Records are for the last 17,000 miles of the above. No figures for train loads given. Compound was found to use 20.3 per cent. less coal per engine-mile than the simple, and 10 per cent. more oil.

They also give results of comparative tests on 10 trips, as follows:

Percentage train hauled per pound, coal	22.2
Percentage water evaporated per pound coal	11.3

Both in favor of the compound.

Norfolk & Southern Railroad.

Performance sheets record of two months' service, with small mileage (2,400 for 35 runs), in local freight, of one compound and one simple Baldwin mogul. Engines of same general dimensions, except that compound has 10,000 lbs. more on drivers (13.3 per cent.), and 20 lbs. higher pressure than the simple.

Compound was new, while simple was two years old. Car mileage and average cars per train were about the same (latter 35). Compound was found to use: 24 per cent. less coal per engine-mile; 22.2 per cent. less coal per car-mile; 23½ per cent. more oil than the simple.

Gives cost of repairs per mile run to be 24 per cent. more for compound, but as compound was a new engine, this figure appears to your committee of no value. State their general observations indicate increased cost of repairs to compound, on account of extra number of rod and piston packings, construction of crossheads and presence of special parts.

New York, Lake Erie & Western Railroad.

Give record of special tests in ten runs of 140 miles each for one Baldwin ten-wheel compound and one Baldwin simple, in fast freight service. Engines were new when tested. Engines of the same general dimensions, the compound having slight additional weight (1,400 lbs., 1.2 per cent.) on drivers and 25 lbs. higher pressure. The simple hauled on an average 10 per cent. longer and 13 per cent. greater total weight of train than the compound. The results were as follows:

Compound saved over simple:

Coal per engine-mile	15.1	per cent.
Coal per car-mile	8 0	"
Coal per ton-mile	3.85	"
Water per ton-mile	4.12	"

Compound ran 20.7 per cent. further per pint of lubricating oil, and 23.2 per pint of valve oil than the simple.

Above tests were "made with great care and as nearly similar conditions as possible and with same enginemen. Several trips with compound gave much better results than the average, the low average percentages being due to the fact that it was necessary to reduce the weight of trains hauled by compound on account of extremely unfavorable weather, track being blocked by snow." Test of compound made in December and of simple it October.

State that cost of repairs will probably be higher for compound in maintenance of cylinders, but say that "our boiler repairs to compound are much less than with simple engine. No repairs have been made to compound's boiler since its purchase and flues have constantly been tight, which cannot be said of simple engine purchased at same time." Service, apparently, 40,000 to 50,000 miles at date of report.

Chicago & Northwestern Railway.

Give results of performance sheets, figures for Schenectady simple and compound and Baldwin compound, in both freight and passenger service.

First, give results in freight for five simple and one compound Schenectady engines, engines same specifications except that compound has 4-in. larger wheels and 20 lbs. higher pressure, with a trifle less weight on drivers. Engines all new and records cover six months' service, 27,000 to 35,000 miles. Service is estimated to be about the same for all, engines running first in first out.

Results show compound to use:

7.7 per cent. less coal per engine-mile and 27.0 per cent. less lubricating oil than the simple.

Second, give results for a Baldwin 10-wheel compound, which may be compared with the five Schenectady simples above. Engines are on nearly same specifications, except that compound has 4-in. larger drivers with somewhat larger boiler and longer firebox and 20 lbs. higher pressure than the simples. Mr. Wm. Smith considers the comparison quite fair, however. The results show the compound as using 3.0 per cent. more coal per engine mile and 20 per cent. less lubricating oil than the simple.

Third, give results in passenger service for a Baldwin eight-wheel compound and a Schenectady eight-wheel simple. Engines are not built on same specifications, the compound having 6,000 lbs. (10 per cent.) more weight on drivers, 2-in. larger boiler, with shallow firebox (simple having deep firebox) and 40 lbs. higher pressure than the simple. The latter is also four years old, while the former is a new engine. Mileage, 15,000 to 23,000 miles for simple. Records are from performance sheets and show compounds to use 10 per cent. less coal per engine-mile and 21.5 per cent. less lubricating oil than the simple.

State that they cannot yet say whether repairs will be greater or less for compounds. They think there may be a small saving for compounds in repairs of flues, but see no other particulars in which they are likely to effect a saving. Have had some little trouble with breakage of an intercepting valve on the Schenectady and some irregular wear on Baldwin crossheads. In letter accompanying data, Mr. Smith states he thinks "it will take a pretty good compound to beat a modern simple engine."

Kings County Elevated Railway.

Give records from performance sheets of average of several simple and one Rhode Island compound engine. Record covers about 50,000 miles service, or one year. Engines are similar in type; compound has 2,000 lbs. (5 per cent.) greater weight on drivers, a slightly larger boiler and grate service, considerable greater heating service and 30 lbs. higher pressure than the simple engines. Hard coal is burned.

The car mileage and weight of train hauled average the same for both engines.

Results show compound to save:

Coal per car-mile.....24 per cent.
Coal per ton-mile.....21 per cent.

Mr. Hedley considers the tests very conclusive ones, as the engines hauled the same trains and performed precisely the same work.

No figures are given for repairs, but opinion is expressed that, on the whole, repairs will be very slightly increased for the compound, the balance being struck between increased cost of taking care of slide and intercepting valves, and marked decrease in repairs to boiler of compound.

Cleveland, Akron & Columbus Railway.

Report figures from performance sheets covering about 40,000 miles run of two Baldwin 8-wheel passenger engines, one simple and one compound. According to figures given engines are of identical dimensions, of same weight, and both run at 180-lbs. pressure.

Average train for compound was 3 cars, and for simple 4 cars, the average weight of compound's train being 16 per cent. less than that of the simple.

Under these conditions, records show that compound saved:

Coal per engine-mile.....32 per cent.
Coal per car-mile.....15 per cent.

Oil used is given as slightly less for compound, and repairs same for both.

Quoting from Mr. Johnstone's letter, he says, "From our experience with these compounds, I am led to believe that repairs to boiler and machinery will always be so much lighter than with simple engines doing the same work as to quite offset the additional repairs made necessary by the number of parts about the cylinders and pistons, and therefore the total cost of repairs will compare favorably with simple engines doing the same work. The general belief is that compound engines must use more oil than simple engines, but the performance of these six compounds goes to show that such is not the case. Being of the opinion that these engines would require more valve oil, I did not limit the engines in its use and I am surprised to see the results as shown. Engineers say they have used all they found necessary, and this seems to have been the case, as we find the cylinders and valves in perfect condition when uncovered after a year's service. With these figures before us and with my knowledge of the ease with which these engines are performing their work, I feel confident in claiming that the economy effected in total expenses will be from 15 to 20 per cent. over engines of exactly the same dimensions and weight."

Norfolk & Western Railroad.

Comparative tests made in passenger service of a Baldwin compound 10-wheel engine and a Rogers 10-wheel simple engine. Engines of similar type, the compound having 5,000 lbs. more on drivers (five per cent.), 8 in. larger drivers and 35 lbs. higher pressure that the simple engine, the compound being a new engine and the simple two years old. No remarks made as to conditions and results; but as latter were worked out with care and fullness, it is presumed that conditions were similar. Tests were made with each engine on four different trains. Average results are given as follows, in percentage of economy of compound over simple:

Coal per ton-mile.....13.4
Coal per car-mile.....20.4
Water per ton-mile.....8.6
Water per car-mile.....16.3

Cincinnati, New Orleans & Texas Pacific Railway.

Extensive tests, made under the supervision of a member of your Committee, of two Baldwin 10-wheel passenger compounds and one simple, the latter being three years old and the former new. The engines were of similar type, the compound, however, having about 5,000 lbs. more on the drivers (6.2 per cent.), a larger boiler, 16 per cent. more heating surface and 6 in larger driving wheels than the simple. Steam pressures not given. Results given for 10 runs with each engine, of about 100 miles each. The compound had about 2 per cent. heavier trains and hauled 3 per cent. more car-miles. Average speed, same for both.

Saving for compound was as follows:

Coal per engine-mile.....33.7 per cent.
Coal per car-mile.....45.5 per cent.
Coal per ton-mile.....35.2 per cent.
Evaporation per pound of coal.....28.7 per cent.

Mr. Meehan comments upon the much more efficient evaporation obtained with the compound than with the simple, saying that the former was much cleaner and threw fewer sparks; also states that indicator cards show the greater proportion of work in the compound is performed in the low pressure cylinders.

Cannot tell yet the expense of repairs with the compound, but believes it will be greater than with the simple, reciprocating parts being heavier. Believes some part of higher per centage of economy shown above is due to larger heating surface of compound. In final summing up, expresses very positive belief in the large economy and varied usefulness of compounds.

Chicago, Burlington & Quincy Railroad.

At the February, 1893, meeting of the Western Railway Club Mr. William Forsyth presented some elaborate tests of compound and simple engines in fast passenger service. The engines were of different types and unlike in weight, capacity, boilers, cylinders, etc., and the tests were not made to establish the comparative value of simple and compound engines, but rather to develop the best type for the particular service met with on that road. As this interesting paper has been widely published and discussed, it is not necessary to detail the results here further than to give some of the general conclusions deduced by Mr. Forsyth:

1st. The average rate of evaporation was 5 per cent. more with the simple than with the Baldwin 10-wheel compound.

2d. The cylinder performance measured by the indicator cards, taken at average running speed, 45 miles per hour, shows 18 per cent. more foot-pounds of work done per heat unit in the steam used by the simple engine than by the Baldwin compound.

3d. At 30 miles per hour the cards show the Baldwin engine to have the best economy, developing 14 per cent. more work per heat unit than the simples.

4th. The poor showing made by the Baldwin compound was largely due to the heavy train and high speed. With a lighter train, or the same train on a lower schedule, it would have shown a much better economy. The cards taken at 30 miles per hour show this.

5th. The Baldwin compound engine, as operated on the C., B. & Q. Railroad on trains 1 and 6, weighing 360 to 400 tons, was not as economical in the use of coal as the C., B. & Q. simple "H" engines by about 25 per cent. When worked in heavy express service the Baldwin compound, 82, lost the principal advantages of compounding, namely: A. High initial pressure in the cylinders; B. Increased number of expansions; C. Soft blast on fire. As a result its boiler performance and cylinder performance were not as good as simple engines of proper capacity.

In letter they state that they do not believe the time has come to draw proper conclusions as to the net value of compounds. Believe any new type has weak points which can be corrected by experience. Think there would be an advantage in compounds on account of less trouble from hot driving boxes (presumably on account of more uniform turning moment of this type); at least that is their experience so far with the two types of same class. They prefer the simplest possible design of starting mechanism, and commend the Lindner valve for this purpose.

Pennsylvania & Northwestern Railway.

Give performance sheet records of eight Baldwin consolidation compounds and eight same simples. Engines of same design and general dimensions, but compounds having 9,000 lbs. more on drivers and carrying 45 lbs. higher pressure than simples.

Table No. 14, below, gives compilation of results furnished your committee.

Chicago, Milwaukee & St. Paul Railroad.

Your committee presented last year results of tests of a Baldwin 10-wheel freight compound, compared with an exactly similar simple. Since that time these engines have been in regular service, and the following tables, No. 1 to 13 inclusive, have been compiled, giving results appearing on the regular monthly performance sheets. The tables show performance of 10 engines, in which the compound No. 827 appears. These engines are of the same class and were all built by the Baldwin company and put in service in February, 1892. It has been thought advisable to give these results in more detail than those from other roads, for the reason that your committee have full knowledge of the conditions and can speak more intelligently of the same than in other cases. Tables No. 1 to 11, inclusive, give monthly performances. [Tables omitted.—EDITOR].

Up to the date of this report, five of the engines had been "shopped," and in order to obtain some idea of the comparative cost of the compound for repairs at a period when all required general overhauling to put them into first-class condition again, Table No. 13 has been compiled. The results shown will be referred to further on.

Remarks Upon Information Collected.

It will be seen that the foregoing information, collected from various sections of the country, tend to indicate on their face, almost unanimously, a varying but large economy of fuel for the compound when compared with simple engines. Your committee feel obliged to state that they are not willing to accept all these results at their face value in contributing to a final solution of the question of fuel economy. Presumably, the tests were submitted as being more or less comparable, and yet in some cases they are obviously only remotely so, and not one word of explanation accompanied them. Your committee, therefore, respectfully submit the figures to the wisdom of the Association, with a few individual comments.

Referring to last year's report, in the final paragraph the prediction was ventured that with variable Western coals an average economy for compounds in freight service should approximate 17 per cent., this figure being the maximum obtainable, upon the average, with engines worked in the best manner, in perfect physical condition and in what may be called characteristic freight service of the country. It is interesting to examine the further figures here given for the same engines used for basis of last year's report, and which have had an additional year's service. See report from C., M. & St. P. railway and tables 1 to 13. The first fact to be drawn from the figures is that while the averages of nine simple engines probably give a very just and close approximation to the operating cost of that class of engines for the given conditions, a comparison of same with only one compound can hardly be called conclusive; and yet the results are valuable, taken together with the committee tests of last year, and tend to confirm the latter, particularly as an attempt was made to eliminate the effect of "individual running" by changing enginemen.

The only advantage, if this can be called an advantage, which the compound enjoyed was that it carried 20 lbs. higher pressure than the simples. It is but fair, however, to repeat here that the high pressure was needed for the compound to put it upon an equality with the simples in hauling power, the former having been under-cylindered. In last year's tests the committee raised the pressure on the simple to 200 lbs. (same as the compound), but failed to identify the resulting coal economy, and were obliged to reduce the pressure again on account of under-balance of the valves.

It will be seen from these figures that the increased coal economy obtained with a compound engine of the Vauclain system, under the given, and average, freight conditions in last year's tests (17 per cent.), is somewhat reduced in more prolonged service by a figure depending upon the amount of work expended upon the compound to keep its valves in fair condition, but that the average economy hardly falls below 12 per cent., allowing cost of repairs to still be kept within a practical figure. It will be noticed that your committee do not say "within the average figure," as they are not prepared to say the practicable will be the average; the word is rather taken to mean an amount consistent with the ordinary regularity of performance of the engine, an important consideration.

The above is limited to apply to the Vauclain system of compounding, as the piston valves there used are, in the opinion of your committee, certain to require more careful watching than the common form of slide valve.

As to standing of the compound in respect to other operating expenses, some information may be extracted from the tables. It would appear that the amount of valve oil required for the Vauclain engine is considerably in excess of that of the simple—according to Table 13, about 20 per cent. more, the machine oil needed being about the same. The above seems a reasonable conclusion for this type of engine. Of course the valve oil question is not of very vital importance if the fuel economy stands at the figures referred to above, but the question of repairs may easily turn the scale in either direction in net results. In Table 13 the repairs per mile are given for five engines for the first 55,000 miles of their life, and including in each a general shop overhauling. According to these figures, the compound stands just with the average. Members of the Association are at liberty to draw their own conclusions therefrom; your committee believe them not unfavorable to the compound, as far as they go; they partially dispose of the fear that a compound would prove an unserviceable machine from frequent untimely breakdowns. As the repairs above given include only the customary ones in the first period of an engine's life, such as turning tires, renewing packing, one or more new crankpins, driving box brasses and general lining-up and overhauling, they do not dispose of the question of wearing out of additional parts and surfaces of the compound nor, to offset this, the increased economy of compound in boiler repairs, as is claimed by many to exist.

CONCLUSION.

The possibility of fuel economy was first denied because, it was argued, we have only marine and stationary practice to turn to, and there the work done is fairly constant, and is consequently well adapted to compounding, in which the cylinder ratio is an all important factor. This reasoning is not sound, and the falsity of its conclusions has been conclusively shown in the past two years; for one example, see conclusions of this committee last year, where they presented tables showing an even wider range of economical performance for the compound than for the simple; of course, both types fall off seriously in economy under variable conditions, but the compound less so than the simple.

Another argument advanced against the compound is that new machines always give economical results while watched; this is emphatically true, and constitutes the most serious stumbling block to the conscientious investigator. It is, however, not more applicable to compound engines than to any other machinery, and the economical results obtained from simples in long service should lead us to hope for the same of compounds, at least at this stage of the question, when it has been shown that they will run 50,000 miles and over, without serious impairment of efficiency.

Turning again to fuel economy, your committee believe the greater number of thinking and observing men in the profession to-day believe the compound will save coal, under certain conditions; some of these men deny that these conditions can be fulfilled in practical railroad service. Others say that the fuel economy will be wined out by increased cost of other supplies and repairs. One condition referred to above is that the compound it not as powerful a machine as a like simple, and must be provided with a starting valve to allow it to work simple in starting and on hills; this valve, it is claimed, will wipe out the economy because it will be habitually used, not so much from carelessness of enginemen, as from the fact that the Operating Department will find out they have a more powerful machine at their disposal when the occasion requires, and will load the train until the habitual use of the valve becomes a necessity. From one point of view it may be with justice said that no one would expect economy under such conditions; but it can be with equal justice affirmed that master mechanics will have to meet this condition. It therefore behooves designers to strive for equal power for the compound without the use of such a valve.

As to the other question, of repairs, your committee have brought results as nearly up to date as practicable, and are not disposed to go far behind the figures in offering a definite conclusion: the compound is a new machine, it is subject to certain crudities of all new designs; these will constitute defects which will cost more for maintenance than the perfected points of the older type. But no evidence has been advanced to show that these defects cannot be remedied by time, and this part of the question resolves itself to considerable of extra cost of maintenance of additional parts in the compound. As the fuel saving possible is not an excessive amount, it points to the conclusion that we must strive for greatest simplicity and greatest reduction of number of such parts in the new type, if we are to expect a net saving in service.

Your committee offer tentatively the following opinions and suggestions:

1. The compound is suitable for a variable class of freight service.
2. Its range of economy in such service is fully as wide as that of the simple.
3. Its increased coal economy over the simple in the average freight service of the country will be found to lie between 10 and 15 per cent. when in good running condition and handled with intelligence.
4. A well designed compound should not be more difficult to keep in a serviceable condition than a simple; that is, its regularity of performance should not be less than the simple.
5. The four-cylinder compound will cost more for valve oil than a simple.
6. The running repairs of a four-cylinder compound will be somewhat more than for simple; four a two-cylinder compound, they should not be more; the final comparison for repairs is undetermined.
7. The net running cost of a compound will be less on many roads than of simple, the figure depending on the design, cost of fuel and other local conditions.
10. In passenger service the availability of the compound is undetermined.
11. Complicated designs of compounds are not likely to prove successful or economical. The prevailing forms of starting valves in use in this country are especially noted as being too complicated—certain valves employed abroad seem to have more commendable points.
12. Attention is called to the necessity of long time tests and averages of a considerable number of exactly similar engines of both types to properly establish the status of the question. In such tests the influence of higher pressure for either type should not be allowed to complicate the results, as the effect of the highest modern steam pressures on economy of the simple is undetermined.

Committee: GEORGE GIBBS, WILLIAM H. LEWIS, PULASKI LEEDS, JAMES MEEHAN, T. W. GENTRY.

TABLE No. 12, C., M. & ST. P. RAILWAY.

General Average of 10 Class D Engines, La Crosse Division for 11 months, June, 1892, to April, 1893, inclusive.

Engines.	Miles per ton of coal.	Saving per cent.	Pounds of coal per eng.-mile	Saving per cent.
Average of nine simple engines	21.99	.....	92.52	.....
One compound engine. All engineers	24.34	10.7	83.72	9.5
Compound with Engineer Rusch, five months	27.21	17.5	74.04	15.0
Average of nine simple engines, same months.	23.15	.....	87.44	.....
Compound with Engineer Fidlin, six months	21.94	4.3	91.78	5.1
Average of nine simple engines, same months.	21.03	.....	96.76	.....
Simple engine with Engineer Rusch, 5 months	21.27	2.1	95.74	2.0
Average of eight other simple engines, same months	20.83	.....	97.56	.....
Simple engine with Engineer Fidlin, four months	21.91	5.	91.26	4.4
Average of eight other simple engines, same months	23.18	.....	87.45	.....

TABLE NO. 13.

Cost of five engines for 15 months (about 55,000 miles run each), including all repairs from time engines were received from builders until receiving general shop repairs.

	Engine 821.	Engine 822.	Engine 825.	Engine 826.	Engine (com'd) 872.
Miles to one ton of coal	22.40	22.05	22.42	19.45	21.84
Miles to one pint of valve oil	53.56	47.52	52.65	46.69	39.52
Miles to one pint of machine oil	19.74	18.68	19.21	17.87	20.52
Repairs per mile, in cents	4.01	3.91	4.82	4.22	4.26

TABLE NO. 14.—PENNSYLVANIA & NORTHWESTERN RAILROAD.

Dates.	Engines.	Average mileage.	Average cost per mile run, in cents.				Average saving for compound.		Average cars handled.	
			Coal.	Material.	Labor.	Total.	Coal	Total.	Loaded.	Empty.
							Per cent.	Per cent.		
May, 1892	Nine simple	1,883.1	6.47	1.54	1.55	9.58			327.6	364.1
May, 1892	Nine compound	2,062.2	4.94	.27	.66	5 89	24	38	358.7	379.2
June, 1892	Nine simple	2,079.3	6.74	.87	.69	8.28			397.6	397.5
June, 1892	Nine compound	1,987.3	5 09	.35	.65	6.06	24	26	345.1	359.7
July, 1892	Nine simple	2,001.6	6.24	.66	.50	7.40			344.0	360.0
July, 1892	Nine compound	1,722.0	5.17	.38	.50	6.44	17	18	292.0	320.0
August, 1892	Nine simple	1,878.1	6.78	.41	.36	7 57			344.1	349.7
August, 1892	Nine compound	1,767.6	5.39	.45	.77	6 63	26	12	297.2	350.2
September, 1892	Eight simple	1,456.1	5.39	.82	1.57	7.68			230.4	246.6
September, 1892	Eight compound	1,459.7	4.38	.67	1.13	6.16	20	19	247.8	287.2
October, 1892	Eight simple	1,669.6	7.13	1.10	.59	8.82			291.5	344 1
October, 1892	Eight compound	1,660.0	5.70	.53	1.19	7 42	20	16	227.7	357.3
November, 1892	Eight simple	1,664.0	6.58	1.03	.81	8.42			285.0	315.0
November, 1892	Eight compound	1,791.0	5.38	.43	.74	6 84	18	22	284.0	354.0
December, 1892	Seven simple	1,837.7	6.29	1.09	.67	8.05			356.0	383.0
December, 1892	Seven compound	1,953.0	6.24	.58	.61	7.43	00	7	406.0	337.0
January, 1893	Eight simple	1,315.0	7.58	.60	1.03	9.24			190.0	228.0
January, 1893	Eight compound	1,421.0	6.49	49	.78	6.97	25	16	192.0	231.0
Average nine months	Simple	1,747.1	6.59	.92	.86	8.33			314.0	329.5
Average nine months	Compound	1,769.3	5.40	.46	.78	6.65	18	20	283.4	330.6
Saving in favor of compound		.....	18 p. c.	49 p. c.	9 p. c.	20 p. c.	.....	.....	....	

Mr. Vauclain—Up to the present time we have some 460 compounds, all told, on order, and we have slightly more than the number given in the report in service. I take exception to the tentative opinion expressed in the report that the compound is suitable for a variable class of freight service. We consider that the compound is suitable for all classes of freight service. The second opinion is that "Its range of economy in such service is fully as wide as that of the simple." It seems to me that that would read better if it said that its range of performance or of coal consumption per ton per mile is fully as wide as that of the simple engine. I think that 10 to 15 per cent. is the minimum fuel economy on any compound engine of any type, two-cylinder, three-cylinder or four-cylinder. On heavy grades with very heavy engines the economy has reached as high a figure as 44.9 per cent. This was done on the Western Maryland Railroad.

The sixth opinion of the Committee is that "The running repairs of a four-cylinder compound will be somewhat more than for a simple; for a two-cylinder compound they should not be more; the final comparison for repairs is undetermined." The only additional repairs that can be given to a compound locomotive above a simple locomotive would be the repairs due to the cylinders. I am willing to concede, although it is not exactly true, that a four-cylinder compound should have twice the repairs to its cylinders and cylinder parts as a two-cylinder engine; intercepting valves, etc., of course are not included. The large item of repairs is the boiler repairs, and it has been clearly proved that the boiler repairs to compound locomotives are much less than to single expansion engines. The percentage of repairs to cylinders is so slight that you can afford to cancel it entirely.

You have the advantage of decreased repairs to your boilers which more than offsets the increased repairs to the cylinders, and you have your fuel economy, so that there cannot be any question that there is an economy in operating compound locomotives.

The tenth statement is "That in passenger service the availability of the compound is undetermined." I object to this. I think it has been determined. If the Committee would take the trouble to come to the East, where we are running high-speed passenger trains, they would find that compound engines are hauling a great many of those trains, and hauling them well.

As to the eleventh point, it would seem that we are not to encourage the builders of two-cylinder compounds in this country, that necessarily must use starting valves. It intimates that the starting valves abroad are very much more desirable than the starting valves that we have at home. I am of the opinion that the starting valves used in America are very much better than the starting valves used abroad.

On several railroads that have reported fuel economy to the Baldwin Locomotive Works it has been found that those people could afford to set that engine to one side and get a brand new engine in five years on the fuel that that engine had saved. On the Pike's Peak rack road, which has a grade of 25 per cent., we made three plain engines for that service. They needed an additional engine. We persuaded them to have a compound. The engine was built and the three plain engines were sent back to our works to be changed into compounds, and they are now in service on the Pike's Peak road. What it has done is best shown by this letter: "From the little experience we have had with this engine we think she is going to do the same work as our 28-ton engine on two-thirds of the coal, and make the run from Manitou to Pike's Peak in 33 to 35 minutes quicker time."

Mr. Barnes—I will ask if any one has ever seen a set of indicator cards from a compound locomotive at 60 miles an hour that was a credit to the engine. The indicator cards give evidence of a loss of efficiency when compared with the 60 miles an hour over any engine I have ever seen. This is in contradiction of Mr. Vauclain's statement.

Mr. Leeds—I protest against the statement going in that the compound is 39 per cent. more economical in repairs than the average of the engines on any railroad. On our own system ten or twelve engines a year are condemned. Each goes in as running repairs, distributed over all the rest, of course, and incidentally with the new engine. Next comes a class of engine which it takes very good judgment to say whether it is worth while to put the extensive repairs on them necessary to maintain them—whether it would be a good idea to condemn 25 or 30 instead of 8 or 10. That all goes in, and still we are asked to compare that with a brand new engine. I take exception to the statement that no repairs are due to the compound engine except cylinder repairs. Whenever I can get rid of a pound in my reciprocating parts I try to do it, for the very reason that it carries extra weight in the engine, all the way through, and not only that, a weight that is effective only a part of the time, and the rest of the time it is more or less destructive.

Mr. Mitchell—I see by this report that on the New York, Lake Erie & Western the compounds show a large saving in lubricating oil. I wish to state in explanation of that that we had 45 engines built, one of which was a compound. On the compound we had one man. We took the consumption of oil with this one engine with the regular man against the average for the 44 which showed this saving. So this is not a correct comparison between two individual engines.

Mr. Henderson—Mr. Vauclain spoke of cylinder repairs and of a record that had been kept by a railroad. That railroad was the Norfolk & Western. We kept a record for the first four months of this year of the proportion which cylinder repairs bore to the total repairs on simple engines. In four months the cylinder repairs were about 2¾ per cent. of the total repairs to locomotives. Our annual report for 1892 showed that for 100 miles run fuel cost $3.86 and repairs $6.36. Now, if we assume the cylinder repairs to be 2¾ per cent. of the total amount of repairs, we have 2¾ per cent. of $6.36, equal to 17½ cents for 100 miles run due to cylinder repairs. Our coal cost us 78 cents a ton. If we assume the economy of the compound engine to be 10 per cent., and finding that our fuel for 100 miles run averaged $3.86, we find the saving to be 38 cents for 100 miles run for coal. If we assume the cylinder repairs of the compound to be double that of the simple, we have a deduction to make from the fuel saving of 17½ cents per 100 miles run. By deducting that from the 38 cents saved in the coal we still have a saving of 20½ cents per 100 miles; or by dividing the 38 by 17½ we find that if the cylinder repairs were three times as heavy on the compound as on the simple engines they would still barely come up to the saving of fuel. I have taken this compound saving at 10 per cent., whereas experiments show an economy in engine and passenger service of 13 to 20 per cent., and some consolidation freight engines we have recently put in service of the four-cylinder type have shown an average economy in the neighborhood of 20 per cent. in fuel. The firemen very much prefer to run the compound engine; they say it is a soft snap. Taking it at 6,000 miles a year as an average mileage, we find that the saving would be $123 a year. That, of course, seems like a small amount, but if we take into consideration the extra cost of compounding, which is, I believe, $6 an engine, that would show us still a saving of 20 per cent. interest on this extra investment.

Mr. Medway—If there were any doubts in my mind regarding the economy of the compound locomotive they have, I think, been removed during the past few weeks. With an order for a few mogul freight engines from the Rhode Island Locomotive Works we decided to include one compound of two-cylinder type. It was built precisely like the simple engines excepting the parts due to the compounding. The cylinders of the plain engines were 20 in. × 24 in., and those of the compound 21 in. and 31 in. × 26 in., thus making the engines of about equal power. The safety valves were set uniformly at 180 lbs. In order to give the compound a good fair test under every-day conditions, I arranged to put it in competition with the plain engine by having it alternate daily on fast freight trains to Bellows Falls and return. The trains were of substantially the same weight and other conditions about similar. After 10 trips our coal record showed that the compound had effected a saving of 23.2 per cent., which, at $3 per ton, means a saving of about $2,000 per year, or, as Mr. Vauclain says, about the price of the engine in five years. The cost of repairs, however, was largely against the compound, which was due to a weakness of the dashpot and large piston. These parts have now been strengthened, and if the good fuel conditions can be maintained I see no reason why the compound is not a good permanent investment. This, however, can better be determined a few years hence.

Mr. Joughins (Norfolk & Southern)—Last year we ordered from the Baldwin works one freight and one passenger compound. Those engines have been running about eight months. The freight engine is doing what had previously been done by simple engines of exactly the same dimensions, received from the Baldwin people also. We keep an elaborate performance sheet, and rely simply upon that performance sheet, not attempting to make any tests. We find that there has been a uniform saving every month amounting to at least 20 per cent. in fuel. We do not find that the oil has been required more copiously. The repairs are practically the same; that is, the running repairs. But on the passenger engine a great many small matters have gone wrong, due partly perhaps to higher speed, but I think chiefly to undeveloped designs and a little bad workmanship.

I went to the Crewe works when in England last winter, and also to Gateshead, on the Northeastern Railway. At the Crewe works I was surprised to find that they had not built a single compound engine for eight months, excepting the engine which was then under construction, and which is now on exhibition at Chicago. That seemed to indicate that the compound was not quite a success on that road. I then went to the Northeastern Railway to see Mr. Worsdell's works, and he, we all know, has been a very strong advocate of the compound engine. I was still more surprised that they were building 20 locomotives for passenger service, with simple cylinders, and abandoning the compound for that purpose. It was a little difficult to get a definite expression as to their reason for abandoning the compound for passenger service. But in talking to other people they said that they found the compound rather unwieldy for passenger service considering the slight advantages which it gave otherwise.

I think any report which the Committee has made about the consumption of oil is thoroughly valueless. I think that we all know that the locomotive receives the amount of oil which the engineer thinks is needed, which very often is from two to five times the amount actually necessary. Notwithstanding the apparent success of those compound engines on the Reading road and on the Jersey Central, I think that it is still a very undetermined matter about the success of those engines in passenger service.

Mr. Brown—Early this year we built a plain engine and at the same time ordered a compound engine from the Baldwin Locomotive Works. We wanted the engines for hauling heavy milk trains. We let one engine run north one day and the other south. We did that for four days, and then they started out on four days more and changed around, so that they made the same number of miles in the four round trips. We weighed the fuel, and the simple engine used less fuel. The simple engine nozzles were 3½ inches wide. The compound nozzles, when she came in, were 3¾. But she would not steam with anthracite coal until they were shut up to 3⅛ inches. Of course, the more you close the nozzle

the less satisfactory results will be shown on the engine. The result was this: that in the four days run the simple engine had saved 18,300 lbs. The simple engine made about 50.9 lbs., whereas the other was 66 and a decimal.

As regards repairs, we have not had any trouble whatever with the compound cylinders or valves. The heads were taken off when she came in first because the machinist had left a half-inch round file in one of the valves, and she had run from Philadelphia here and did not do any damage except breaking up the file. We got the file out, and that is the last time the head has been off.

Mr. Mackenzie—Some ten months ago we had 10 engines built by the Baldwin Locomotive Works, and in placing the order the President said: "I suppose you want a plaything the same as everybody else. If you want a compound you better get it." So we got the compound engine. We assigned regular men to regular engines, and allowed those men to make 30 days during the month. Whatever time the engine may make beyond that is made by extra men, the regular man being held in all cases responsible for the condition of the engine. We made no test as to weighing the coal or the water or measuring the oil or waste or any other work about the engine. In the eight months the engines have made nearly 32,000 miles, or an average of about 4,000 miles a month. The comparative statement would be, with coal costing $1.77 per ton, a saving in favor of the compound of 31.7 per train-mile. The cost of repairs of the compound over the simple engine is 5 mills per mile. I am not positive as to whether there were any incidental repairs made to the cylinders or not, but we have a record of extended repairs made to the crossheads. Twice during the eight months we hav had to take the crossheads down and reline them. On the eccentrics, links and rocker arms the repairs are going to be very much less than on the simple engine.

Mr. Tonge—So far as our experience goes with the Rhode Island compound it has showed a saving of 12½ per cent., with an increase of repairs of 50 per cent.

Mr. Forsyth—(Answering a question put by Mr Wells.) As to the proper diameter of compound cylinders when you want to meet the par of the simple engine, the English designers and the German designers gave us a rule quite early in the day of compound engines which was to make the compound high pressure cylinder one inch larger in diameter than the simple engine that we want to make it equal to, and within the small range of diameters which we use in high-pressure cylinders this rule seemed to have worked very well.

In regard to the experiment made with compound engines on the C., B. & Q. road last year there is an impression that the results of the tests were unfavorable to compound engines, that is, as a general statement. But the net results of the experiments and the fact that we settle for ourselves were that in fast heavy passenger service the compound engine was not economical and for that kind of service we would prefer a simple engine I think that the two important conclusions to be gained from this discussion to-day and from the report of the committee are simply this, that the experience so far largely points in the direction that compound engines will not show an important economy in fast passenger service. The other fact is that up to this time there seems to be no doubt whatever from the numerous experiments that have been made, and the conclusions of the committee that compound freight engines are economical, and probably more so than the committee have stated in their report. We are now building compound freight engines at our shops at Aurora. I was very much pleased with Mr. Vauclain's discussion of this report. But the trouble is he claims too much for his engine. When he says that it has proved economical in fast passenger service I do not think that carefully conducted tests would show that to be the case. He claims too that fast passenger speed is only possible with a piston valve. I was disposed to agree with him when he wrote a letter to that effect to the *Railroad Gazette*. But the experience of the New York Central road with a plain old-fashioned engine has shown that very high speed can be obtained with the slide valve.

Mr. Wells—Mr. Forsyth spoke of the rule given by English engineers in regard to the size of the high pressure cylinder. They give it as 1 in. over its equivalent in a simple engine. The difference between a cylinder 12 in. or 13 in. in diameter amounts to about 18 or 19 per cent. But the difference between a 20 or 21 in. cylinder is only about 9 per cent. So that the rule is not a correct one for the different sizes. The rule is not correct when you get up to those higher diameters.

Mr. Medway—We have obtained good results from the compound in regard to spark throwing.

Mr. Mitchell—A track sub-foreman on our road told me that with the consolidation engine formerly used on the hill when pushing trains in the dry season it required one or two engines to watch the sparks and put the fires out. Since the compounds have been used there a fire is something never known.

On motion the discussion was closed.

Mr. Geo. H. Baker was elected an associate member. Mr. Willis T. Squires, of the *Railway Age & Northwestern Railroader* was proposed as an associate member and his name was referred to the committee on associate members.

The Committee on Uniform Locomotive Performance Sheets did not present a report and on motion the committee was discharged.

The report on Standard Diameter of Wheel Centres and Tires was presented by the committee on that subject.

Mr. Swanston—I move the adoption of this report and that the sizes be made standard. I understand that this is not the adoption of the new standard, but simply the extension of the one that already exists. Our present standard runs up to 66 in., and this standard simply continues above 66 in.

Mr. Henderson—I would say that we have some 7½-in. bald tires on 10-wheel engines with 60-in. and 68-in. diameter of driving wheels. Several years ago when we used a 6½-in. tire on the front driving wheel there were several accidents of running off the track and wheels slipping, and we have been using 7½-in. tires ever since. Recently we have adopted 7⅛ for consolidation tires, that is for the bald tire. The front and back wheels are flanged and the two middle wheels are bald.

Mr. Swanston's motion was carried, and the meeting then adjourned until the following day.

Improved Switch Point Lock.

The improved point lock shown herewith is being introduced by Messrs. Saxby & Farmer, of London. The object of the appliance is to provide a simple form of switch lock, so that the opening or closing

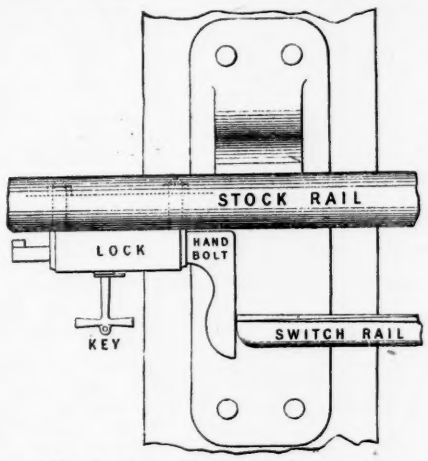

Fig. 1—Points Unbolted and Opened.

of the switch is controlled only by the person possessing the key. The lock is bolted to the stock-rail by a couple of bolts as shown in figs. 1 and 2, the former showing points unbolted and opened and the key inserted in the lock, while fig. 2 shows the points closed,

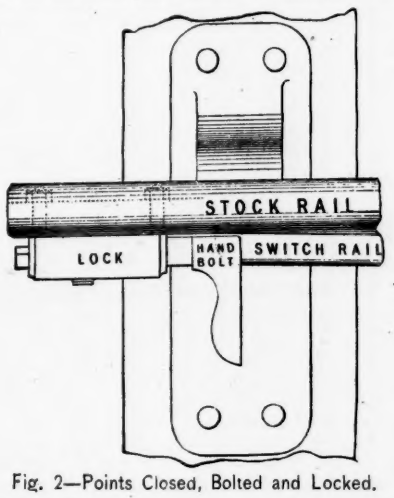

Fig. 2—Points Closed, Bolted and Locked.

bolted, locked and the key removed. The hand-bolt is pulled by hand backward or forward and acts direct upon the switch to lock or unlock it. When locked the switch-rail is forced to close up the stock-rail by the hand-bolt, the key then locks the hand-bolt and prevents the latter being shifted after the key is

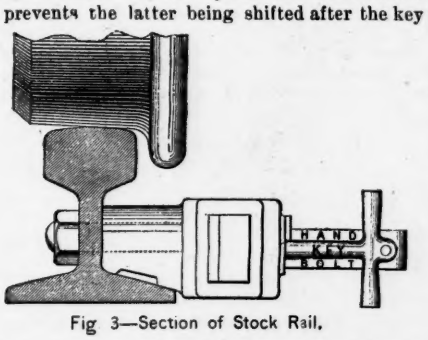

Fig 3—Section of Stock Rail.

withdrawn. This obviates the risk of the points being partly opened when supposed to be locked, in consequence of looseness of joints, extension of rods or other imperfections. The key is small and light, as it is only required to lock the bolt, and not to move it. Fig. 3 shows a section through the stock-rail, with an end view of the hand-lock and key in position. For the description and cuts we are indebted to *Industries*.

Iron and Steel Works in China.

Several years ago rich deposits of anthracite coal and iron ore were discovered in China and efforts were at once instituted by the Viceroy of the Provinces Liang-Hu to properly work them. European engineers were employed, and as a result the development of the mines was taken in hand and blast furnaces and steel works and an arsenal at Hanyang, and an engineering school and laboratory at Wu-Chong are now in an advanced stage of completion, and, in part, ready for work. The metallurgical works, according to an account in the *Moniteur Industriel*, are situated at the juncture of the rivers Hang and Yangtze, where temporary docks for transportation purposes have been established. Substantial docks, equipped with cranes and all other necessary appliances to facilitate the handling of materials, are now in course of construction on the left bank of the river Yangtze. Transportation will then be easily effected by water.

There will be two blast furnaces having each a daily capacity of 50 tons. Each furnace will have three Cowper hot blast stoves and accompanying blowing engines. The furnaces will be charged from an overhead railroad. The puddling furnaces, twenty in number, will be arranged in series of five, and the waste gases will be used under the steam boilers. There will be a Siemens-Martin furnace of 10 ton capacity intended specially for the manufacture of mild steel. The roll trains will be driven by two powerful horizontal engines, and all the latest appliances for rail-making will be introduced. There will be also two 5-ton Bessemer converters. Steam for all purposes will be furnished by 11 Lancashire boilers. An important adjunct to the works will be a machine and a wagon shop for railroad work.

The iron ore will come from mines at Tieh-Shan-p'u, in the Ta-Yah district, and is of a rich, magnetic variety. It will be taken by rail to Shih-hui-Yao, 17 miles distant, on the banks of the Yangtze, and thence will be carried by water direct to the works. To the west of these will be established a small arms factory and a gun foundry, and provisions will also be made for the manufacture of ammunition. All the machinery there, too, will be of the most modern character. The annual capacity of the foundry will be about 100 cannon of varying calibre, and that of the small arms factory, 15,000 rifles. To provide the personnel necessary for all these establishments, the laboratories and school at Wu-Chong have been much extended and improved, and since July of last year regular courses of instruction in engineering have been followed.

Factory-Driving by Electricity on the Northern Railroad of France.*

During the last 10 years the use of electricity has greatly increased on the Northern Railroad of France. The telegraph and telephone circuits have an extent of 5 500 miles, with 1,500 offices. The block system is used upon 700 miles; 2,555 large electric bells are used for announcing the arrival of trains. There are also in use 6,200 electrical apparatuses for working signals and switches at a distance, and 1,027 electric contacts fixed to distant-signal discs. There are 18 generating stations with a total of 1,200 H. P. This number will be shortly increased to 26, and the horse power to 2,600; the electric current is now supplied to 25 stations, and this number will shortly be increased to 37. The electricity produced is used for arc and incandescent lighting, and for driving capstans and cranes, for charging accumulators, which are employed while the dynamos are idle, and also for the cells which are used for the trials of electric lighting on the trains.

Until recently the laboratories, store departments, workshops and offices belonging to the electrical department were scattered in different places, but on the advice of Mr. A. Sartiaux, the Chief Engineer, all the various branches have now been concentrated at Saint-Ouen-les-Docks, near the steam tramway station on the Quai-de-Seine. Formerly, the whole of the plant was driven by a gas engine, but Mr. Sartiaux had found that the work of all classes was so intermittent that the power would be supplied more satisfactorily by electricity, using accumulators.

During the building of the station known as Calais-maritime the company had constructed a temporary wooden structure upon the quay itself. This building was afterward removed to Saint-Ouen-les-Docks. The area covered is 2,250 sq. yds., and the open wharfs are 7,156 sq. yds. in extent, making a total of 9,406 sq. yds. Railroad lines run into these wharves, and also serve the works of the Société pour le travail électrique des métaux and the Société d'éclairage et de force par l'électricité, both on the opposite side of the Rue Lamonta. The trucks are moved about by electric capstans.

All the heavy articles and machines are on the ground floor, and blocks and tackle capable of lifting three tons each are fixed to the roof trusses. The warehouses and adjoining buildings are lighted by twelve arc lamps, using 6 to 8 and 12 to 15 amperes run two in series. The offices are lighted by glowlamps and warmed by gas; they are separated from the warehouses and workshops by glass partitions. The physical and chemical laboratories are on the ground floor, and contain a very complete series of apparatus for the measurement of resistance, insulation and for photometry. The laboratories are also lighted by glowlamps and heated by gas. The machine shops are partly on the ground floor and partly on a gallery.

All the machine tools are driven by electric motors, instead of by a gas engine of 12 H. P. formerly used. The arrangement is due to Mr. Eugene Sartiaux, the head of the electrical department of the Northern Company, in conjunction with Messrs. Hillairet and Huguet, and the existing machines have been altered as little as possible. The author divides the tools into three groups, the first consisting of large lathes, the second of drilling machines and the third of various tools, such as planing machines, milling machines, fans and grindstones. There are seven lathes, driven in three different ways. These lathes are each driven by a motor of 1,100 watt power. The motor is placed behind the lathe, and mounted on a cast iron bed; the armature shaft carries a pinion which gears into a spur wheel upon a shaft carrying the usual counter-shaft speed cones. The two parts of the driving belt which passes to the cone on the lathe mandril run over jockey pulleys mounted on a slide, and controlled by a lever with a counterweight which raises the pulleys and stretches the belt. A light pressure upon the lever releases the jockey pulleys and

*Abstracts of papers—Institution of Civil Engineers.

stops the lathe, while allowing the motor still to run. The motor can be stopped by a switch also, and this is provided with a series of contacts, so that graduated resistances are put in, thus avoiding excessive currents in the armature at starting. Two other lathes are each driven by a two-pole motor of 300 watts. In one case the lathe is actuated by belting, and in the other by friction gear. Two small watchmaker's lathes are driven by an eight-pole motor of 65 watts, through gut bands. Five drilling machines are in use: one radial drill is driven by a two-pole motor of 1,100 watts, fixed upon the speed cone shaft itself, and driving thence to the second speed cone by belting.

A large drilling machine, of the vertical type, is driven by a motor of 1,100 watts, and a smaller one by a motor of 300 watts; two very small drills are each driven by a motor of 65 watts. There are also seven other machines of various kinds, and of these the universal milling machine is driven by a motor of 1,100 watts, the grindstone by one of 1,100 watts, and the ribbon saw by one of 2,200 watts. The fan in the smiths' shop is the only new tool, and is driven by a motor of 300 watts through a Raffard elastic coupling; this fan runs at 3,000 revolutions per minute almost all day long. A portable drill is used out of doors and is provided with a motor of 1,100 watts and flexible cables.

Besides these tools, there are a pulverizer and a mixer, used for making the oily ink used on the pads in the office of the company. Both of these machines are driven by an old Gramme motor, which was disused.

The milling machine appears to require most current, taking 11 4 amperes when running light and 15 amperes when at work. Only three types of motors are used, to avoid complication. The average daily consumption of energy has been 11 kilowatt-hours. The current is supplied at the price of 3.65d. per kilowatt-hour, the cost is therefore 3s. 4d. per diem; to this figure must be added the cost of maintenance of the motors, which amounts to 9.6d. per day, making a total cost of 4s. 1.6d. per diem. An Aron meter is used for measuring the current supplied. When a gas engine was in use, the cost per diem for gas, water, waste, oil, repairs and maintenance was a little over 10s. 5d. The attendant, who was formerly required to look after the gas engine and shafting has been dispensed with, and each workman cleans his machine and motor during two hours on Saturday.

TECHNICAL.

Manufacturing and Business.

The Denver & Rio Grande has let contracts for the next year's supply of castings to F. P. Larmon & Co., Pueblo, and Cordingly & Goodstein, of Denver. These contracts amount to from $50,000 to $75,000.

The Dimon & Adams Manufacturing Company has closed a contract with the Denver & Rio Grande to furnish frogs for the new 75-lb. rails to be laid between Salida and Leadville, Col., and with the Atchison for two carloads of frogs.

The Mack locomotive boiler circulator (illustrated in the *Railroad Gazette* of Dec. 30, 1892) has been in use on an engine on the Boston & Albany for the past six months. Mr. Underhill, Superintendent of Motive Power, reports that the engine works well and gives no trouble, running on a suburban train every day. During the months of March and April she averaged 46.62 miles to 2,000 lbs. coal, which is a very good showing. The circulator is now being applied to two more engines on the same road.

At the special meeting of the stockholders of the Union Switch & Signal Co., last week, the proposition to increase the indebtedness of the company in order to take up bonds which have fallen due was adopted. This is not an actual increase in the debt, but merely an extension of the old bonds. A dividend of 1½ per cent. quarterly was declared on the preferred stock, payable July 15.

The Star Coupler Co., of St. Louis, was incorporated last week by I. G. Brown, S. M. Frede and J. W. Donnell.

The D'Este & Seeley Company, of Boston, has just received a large order for Curtis balance d steam traps from the Geo. W. Newell Co., of Philadelphia.

The Hinson Car Coupler & Manufacturing Co., incorporated under the laws of Illinois, has purchased all the property and rights of the Hinson Car Coupler Company, of Des Moines, Ia., and the property and rights of the Southern Malleable Iron Co., of Chattanooga, Tenn. The capital of the new company is $2,650,000. The officers are F. G. Kammerer, President; W. P. Tuttle, Secretary and Treasurer; J. E. Forsyth, General Manager.

We are informed that the English Admiralty have this year once more awarded to Messrs. Robert Ingham Clark & Co., of London, a large portion of the contract for the supply of varnishes—some 7,500 gallons in all—again including the whole of the body varnish requirements.

Iron and Steel.

The Wheeling Mould & Foundry Co., of Wheeling has been organized for the manufacture of molds of all sorts, structural work and all sorts of castings of iron, brass and other metals.

New Stations and Shops.

Plans have been prepared for a union depot at Trinidad, Col., to be located on East Main street. The building is to be 50 × 150 ft., surrounded by a park enclosure.

The Dunkirk, Alleghany Valley & Pittsburgh is to erect a new passenger station at Warren, Pa.

The Berlin Iron Bridge Co. is putting up a new foundry for the Watts-Campbell Co., at Newark, N. J.

The Columbus, Hocking Valley & Toledo has commenced work at Columbus on a new freight house. It will cover nearly a square of ground and will be located along Naughten street about a square west of the Union station.

The King Bridge Manufacturing Co. filed plans at Cleveland last week for the new building to be erected to replace the structure destroyed by fire a few weeks ago. The plans provide for a building of brick and iron, 200 ft. wide and 320 ft. long and about 22 ft. high. The cost will be $25,000.

The Missouri Pacific is reported to have decided to begin work next September on a new Union station at Little Rock, Ark. The building will cost about $100,000, and will probably be built upon the site of the old station.

A New Trainshed for the Toronto Station.

The contract for the construction of the new trainshed at the Union Station at Toronto, Ont., which is to be erected at the south of the present buildings, has been awarded to the Central Bridge & Engineering Company, Ltd., Peterboro, Ont., and the work will be commenced at once.

A Tanite Polish for Brass and Metal Work.

The Tanite Co., of Stroudsburg, Pa., manufacturers of emery, emery wheels and grinding machines, has just established a new department of manufacture of polishes, in the form of powder, liquid and paste. The powders are intended specially for the European market, where the use of steel knives and the care bestowed on them creates a market for powders to be used on knife boards and in the rotary knife-cleaning machines. The paste is intended for use on brass, zinc, nickel and tin and is especially fitted for use on hot metal. It will give a fine, bright polish as quickly as will the Putz and other compounds, and unlike these it does not stain the hands. It does not even grease the hands, but can be washed off quickly in water. It is adapted for use on the bright work of locomotives and other engines.

The Great Kanawha River Improvements.

A. M. Scott, Resident Engineer of the improvement of the Great Kanawha River, has been notified by the officials of the War Department that the bids of Zimmerman, Truax & Sheridan, of Duluth, Minn., which have been printed in the *Railroad Gazette*, were satisfactory, and to them are awarded the contracts for building locks and dams Nos 9 and 10. No. 11 was given to Thomas Munford, of Lock No. 7, W. Va., who built lock and dam No. 7. The work of getting out stone has already begun, the contract calling for the completion of the work by Jan. 1, 1897. Four government dredgers are at work on the various pools in the Kanawha River, and the improvement of the stream is being carried forward rapidly. The Ward Steam Boiler Works, of Charleston, last week launched a steam cutter to be used by the government engineers on the work; it is 40 ft. long, 12 ft. wide, and without machinery draws only 4 in. of water. With the machinery in, it is to draw 9 in. It is all of steel, and a very substantial affair.

Interlocking.

The Union Switch & Signal Co. is to put in interlocking signals at the crossing of the St. Paul & Duluth and the Minneapolis, St. Paul & Sault Ste. Marie, at Bald Eagle Junction, Minn. Interlocking signals are to be put in at the crossing of the St. Paul & Duluth and the Wisconsin Central, at Gladstone, Minn.

The Illinois Railroad Commissioners have ordered interlocking signals to be put in at the crossing of the Centralia & Chester and the Louisville & Nashville roads, at Nashville, Ill.

Van Dorston Coupler Testing Machine.

The Van Dorston Railway Supply Co. is asking bids for the construction of one of the Van Dorston testing machines, recently illustrated in the *Railroad Gazette*, for testing M. C. B. couplers, which not only gives the service shock tests, but also the tensile shock test. When the machine is completed a thorough test of the Van Dorston cushioned equipment will be made in every detail, separate and together. Other coupler representatives will be invited to participate. Railroad men will receive a general invitation to be present at the tests.

The New Ore Docks at Duluth.

Excellent progress is being made with the construction of ore docks of the Duluth, Missabe & Northern at Duluth, Minn. There is now no difficulty experienced in securing timber, and it is estimated that the entire dock will be completed before Aug. 1. The American Steel Barge Co. has the contract for building the spouts, and Messrs. Pettibone, Milliken & Co. that for the improved Denton hoists.

The Pecos Viaduct.

At the regular meeting of the Engineering Association of the South at Nashville, Tenn., on June 3, a paper on the Pecos Viaduct was presented by Mr. J. Kruttschnitt, General Manager Southern Pacific Co., Atlantic system. In the original construction of the Galveston, Harrisburg & San Antonio R. R., of the Southern Pacific system, the deep cañon of the Pecos River presented such difficulties that, to avoid it, considerable detour was made and the line built with heavy grades and curvature, yet at great expense; besides, the operating expenses were large, the unstable condition of the adjacent limestone necessitating constant patrol of the track and reduction of train speed. These disadvantages led to the location of a cut-off, crossing the Pecos River on the viaduct described. The two lines are thus compared:

	Operated Line.	Cut-off.
Actual length in miles	24.5	13.3
Comparative length reduced to level tangents	33.77	17.9
Wooden trestles, feet	3,600	600
Iron bridging, feet	2,730	2,180
Weight of iron bridging, pounds	3,893,000	3,640,000
Total curvature, degrees	2,926.6	991.7
Maximum degree of curvature	10	5
Maximum grade, feet per mile	52.8	52.8
Rise and fall, feet	902.27	524.38

The masonry piers and footings are of tough limestone laid in Portland cement mortar, and were built between March and November, 1891, 3,270 cu. yds., costing $70,000.

For comparison, the lengths, heights and weights of the six highest viaducts in the world are given:

Name.	Length bet. abutments.	Base of rail to water level.	Weight in lbs.	Wt. pr. sq. ft. vertical projection.	Live load per lin. ft.
Garabit	1,813.00	401.86	7,040,000	22.74	3,220 lbs.
Loa	800.00	336.00	2,497,600	20.00	2,800 "
Pecos	2,180.50	320.89	3,640,000	13.32	5,000 and 30,000 concen.
Malleco	1,139.80	312.90	3,148,886	15.50	2,750 lbs.
Kinzua	2,044.00	301.10	3,500,000	9.10	
Evaux	812.20	299.50	2,682,998	19.17	

This table shows that the Pecos ranks one of the highest viaducts in the world for standard gauge track, also that it leads in live load specifications and lightness. One of the most remarkable features of the work was the traveler used in the erection. It had an overhang of 124.5 ft., perhaps hitherto unequaled, which was secured by a 57-ft. wheel base, the traveler being counterbalanced and clamped to the completed parts of the structure. The iron was brought out on push cars on the permanent track, taken by the crab on the traveler, lowered and held in position till the connections were made. The heaviest pieces weighed 11 tons. After erecting the east half of the structure the traveler was taken to pieces and shipped by the operated line to the west half; meanwhile a lighter traveler raised the short towers at the west end. In erecting the east half 41,000 lbs. of iron was averaged per day, net time; and 62,000 lbs. in the west half. The average number of men employed in erecting was 67; and 87 working days were consumed between beginning erection and connecting the suspended span. The superstructure was built by the Phœnix Bridge Co. The floor timbers are covered by galvanized iron for fire protection. The total cost was a quarter of a million dollars.

The paper was fully illustrated by drawings and photographs.

THE SCRAP HEAP.

Notes.

The steamship line between Vancouver, B. C., and Australia is to be subsidized to the extent of $50,000 a year by the government of New South Wales.

F. L. Flanders, Jr., was sentented to a year's imprisonment by the United States Court, at Kansas City, last week, for using the mails to obtain railroad passes by fraud.

The Chicago & Northwestern has laid off a large number of train crews at Escanaba, and many workmen on the ore docks, in consequence of the dullness in the iron ore trade.

The special compensation to the Western Maryland Railroad for running a fast mail train from Baltimore to Hagerstown, starting at 4:30 a. m., is to be discontinued on July 1. It is stated in a Baltimore paper that the road will probably continue the train, for the present, notwithstanding the reduction in compensation.

A number of passengers in the sleeping car on Northern Pacific train No. 3 were robbed on the night of June 16, near Perham, Minn., the single robber knocking down the porter and intimidating him and most of the passengers with his pistol. One passenger made an outcry and the robber pulled the bell cord, jumped off and escaped.

The high water in the Mississippi River continues to cause considerable trouble and a great deal of anxiety in the region of New Orleans. The New Orleans & Northwestern road is reported as having suspended traffic entirely. The Yazoo & Mississippi Valley trains to and from New Orleans have to run over the Illinois Central tracks via Jackson, Miss.

At Scranton, Pa., on June 18, there was a convention of railroad men, said to represent 186 lodges of the various brotherhoods, to consider the establishment of a Steam Railroad Men's Union for the state of Pennsylvania. It is said that the chief object of the organization is political, and the officers say that "the records of candidates for the legislature will be carefully scrutinized with an impartial eye."

The Lake Shore & Michigan Southern people are now taking their turn at boasting of fast time. On Saturday night, June 17, says a local newspaper, the westbound Exposition flyer left Buffalo an hour and two minutes late, and after losing 10 minutes between Buffalo and Erie on account of a refractory airbrake, Engineer Allen Tyler, with engine No. 598, started 72 minutes late to make the run from Erie to Cleveland. It took him just 96 minutes to cover 95¼ miles, which lie between the union depots of Erie

and Cleveland, the best run ever made on this division of the Lake Shore. The time allowed on the schedule from Erie to Cleveland is one hour and 55 minutes. "After encouragement of that sort the Cleveland engineer took hold of things with the proper spirit and at Elkhart, Ind., all but five minutes of the lost time had been made up. So it is unnecessary to say that flyer 41 rolled into Chicago on time as if nothing had happened."

A fruit shed of the Louisville & Nashville and one of the Illinois Central were burned at New Orleans last week, together with a large quantity of fruit. The total loss of the roads is estimated at about $60,000. The loss to the Lehigh Valley by the fire at the coal station at Buffalo last week is now estimated at $800,000. There was no insurance. The number of freight cars burned was 60. Forest fires did serious damage at Virginia, Minn., and other places on the Duluth, Missabe & Northern Railroad June 18. Special trains of that road brought about 500 homeless people into Duluth on June 19. The fires have been raging for two or three weeks and many small camps that were in danger are yet to be heard from. Near Ashland, Wis., forest fires did a good deal of damage and caused several deaths June 18 and 19. The Northern Pacific lost a bridge near Ashland, Wis., and the Duluth, South Shore & Atlantic lost one at Sanborn.

The reorganization plan of the Pennsylvania Steel Co., which has just been made public, provides for issuing a new mortgage of $9,000,000 upon all the property of the company and of the Maryland Steel Co. Of this $4,000,000 are to be reserved, and the remaining $5,000,000 six per cent. bonds are to be issued at once and offered *pro rata* to the shareholders, who are to have the privilege of taking them at 85, the time of subscription expiring July 20. They may be converted at any time within five years into eight per cent. preferred stock of the company. With the funds thus acquired the company's floating debt will be paid off. The balance sheet shows $17,783,218 assets and $2,472,000 mortgage debt, $5,625,440 bills payable and $1,818,289 wages and other accounts payable. The assets include $697,809 cash and over $3,100,000 bills and accounts receivable The total liabilities are $14,723,658. The report of the accountant states that the assets of both companies exceed every character of liability by the sum of $3.059,559. "Excluding the capital stock of $4,757,300, and the scrip, $50,628, aggregating $4,807,928, which is not, in point of fact, a liability to any one but the stockholders themselves, then there are assets of $7,867,488 in excess of all liabilities."

Shipping Notes.

A nickel-steel crank shaft, as a duplicate for the "Paris," has been made at the Bethlehem Iron Works. The material showed a tensile strength of 90,000 lbs.

The *Marine Review* states that the steamer "Corsica," docked, after the collision, at the Globe Iron Works, Cleveland, on Wednesday, had three new plates put in and one taken out, straightened and replaced, and sailed Saturday of the same week before dark, fully repaired.

The Old Dominion line has ordered two screw passenger steamers, duplicates, 320 ft. over all, 40 ft. beam and 34½ ft. deep, with 3,000 H. P. triple expansion engines and return tubular boilers. They will be built at the Roach shipyard, Chester, Pa., and will cost about $350,000 each.

The whaleback steamer "Columbus," built at the West Superior shipyard to carry passengers to the World's Fair, is said to have made a speed of 23 miles an hour, equal to 19.95 knots. If this is true, the President of the Great Northern, and Miers Coryell, between them, are planning rather slow boats for traffic between Duluth and Buffalo.

Spanish-American Notes.

A nail and wire factory has been started at South Barracas, Argentine.

The Catalinas Wharf & Deposit Co. has been authorized by the Argentine government to connect its railroads with those of the port of Buenos Ayres.

Mr. R. Ayerza, C. E., has been appointed to supersede Dr. Araoz as chairman of the National Railroad Board of Argentine. One of his first acts has been to advise the annulment of a large number of the railroad concessions, on which nothing has been done by the concessionaires.

A recent report that the São Paulo Railway Co., Brazil, was negotiating for the purchase of the Mogyana Railroad is denied. Efforts are, however, being made for a combination to regulate freight tariffs between the São Paulo, the Mogyana, the Paulista and the Sorocabana lines.

The Ecuadorian government has determined, before letting a contract for the extension of the Central Railroad to Riobamba, to have new routes surveyed, there being grave doubts that the former location was as feasible a one as could be found over the mountains to the central plateau. A party of American engineers will probably have charge of this work.

There seems to be a falling off in the receipts from the railroads controlled by the Peruvian corporation. The reports for March show a decrease over the corresponding period of 1892 of $7,950. There was, however, an increase of $7,000 in the returns from the Central (Lima to Oroya) Railroad, but the decrease on the other lines and on the Lake Titicaca traffic amounted to $14,950. The Central Railroad is at present in operation only as far as Casapalca.

The production of the Peruvian oilfields in the vicinity of Talara for 1892 amounted to 185,000 barrels. Of this quantity 120,000 barrels were refined at the works of the Pacific Petroleum Co. at Talara.

An important change is about to take place in the management of the railroad lines of the province of Coquimbo, Chili, due to the efforts of Don Ruperto Alvarez, by means of which the service of these lines will be greatly improved. The two railroad companies of this province, the Coquimbo and the Tongoy, are to be consolidated, and a new company is to be formed, having an administrative connection with the Chilian government. The government will practically take possession of the lines with their rolling stock, and in return will supply material and rolling stock necessary to reduce all the roads to a uniform narrow gauge system. The government will also use the material lately ordered from Europe for the construction of a mole at Valparaiso in the construction of a mole at Coquimbo, to which protected harbor this material is said to be better adapted. For the purchase of the Elqui branch the new consolidated railroad corporations will issue bonds, guaranteed by the state. The project will be laid before Congress at its session this month, and it is understood that the opinion of most of the members is favorable to its consummation. It is warmly indorsed by President Montt.

The official report of the directors of the Central Railroad of Brazil for 1891 has just been published. This road, which is the most important in Brazil, and is under government control, had in operation at the end of that year 695 miles of track, of which 450 miles were 4 ft. 3 in. gauge and 245 miles metre gauge. The total cost of the road had been 130,356,816 mil reis. The mil reis at par equals 54.6 cents. During the time of the empire exchange was usually at par or above, but since then there has been much fluctuation, the rate to-day being 22¾ cents. Of the above sum all was spent upon permanent way, except 3,277,436 mil reis, which had gone into rolling stock. During the year there were run 60,410 trains, making an aggregate train-mileage of 380 858. Passengers transported amounted to 9,394,069, as against 6,621,888 in the previous year. Of this number 7,909,694 were carried by suburban trains. The passenger traffic yielded 4,931,221 mil reis, against 3,380,652 mil reis in the previous year, and the freight traffic produced a revenue of 10,085,848 mil reis, against 7,630,907 mil reis for 1890. The consumption of coal amounted to 75,623 tons, the number of locomotives in operation being 187. The road owns 2,476 miles of telegraph lines and employs 3,097 persons, inclusive of 70 telepraph operators. Within the last two months this road has put into service ten new locomotives of United States manufacture and 15 more have been ordered, which are to be delivered within the next few months.

The Railroad Commerce Congress.

The programme for the Railroad Commerce Congress, in Chicago this week, has been slightly modified since the publication of the list of papers which appeared in the *Railroad Gazette* last week. Two or three of the addresses have been changed to different dates, and the following additional speakers are announced: The protection of private rights in connection with railroad management will be discussed by Mr. M. M. Kirkman as well as by Mr. E. P. Ripley. Superannuation of railroad men, assigned to Mr. L. J. Sargeant, will also be discussed by Mr. R. F. Smith, Superintendent of the Relief Department of the Pennsylvania Lines West of Pittsburgh. Safety appliances will be discussed by Mr. A. W. Soper, President of the Safety Car Heating & Lighting Co., and by Hon. L. S. Coffin, of Iowa. The title of Hon. John F. Dillon's paper is "Constitutional Guarantees of Railroad Properties and Franchises against Legislative Spoliation."

An Inequitable Bargain.

There was a conference in the Mayor's office at Philadelphia this week in reference to the North Penn Junction improvement. The plan contemplates the depressing of the Reading tracks and the elevation of the Pennsylvania's, and changing the grades of several streets. The Reading officers say that company is satisfied to leave the crossing as it is. After a long discussion it was agreed that the city's appropriation of $200,000 and the $100,000 offered by the Pennsylvania Railroad should be employed to make the change in grade, and that the Reading should not pay a cent toward making the improvements. From the start the latter's officials have refused to join in any combination toward the abolishment of the grade crossing, and yesterday both of the two other interests concerned were forced to give in.

In other words, the Pennsylvania, deeming the abolition of the crossing a necessity in the transaction of its business, is forced to pay its own share and that of the other railroad also.

Atlantic Passenger Travel.

The *Evening Post*, New York, has collected some information concerning the trans-Atlantic passenger traffic for the month of May this year and last, showing a decrease in the total, notwithstanding a considerable increase in the westward movement this year. The number of passengers carried both ways by the lines sailing from New York is given in the little table below. The Anchor line and the Guion line are excepted, as their figures were not to be had. A representative of the Anchor line said, however, that their eastward travel was 30 per cent. below last year's, and the westward travel would not quite offset it. Essentially the same was reported by the agents of the Guion line.

	May, 1892.	May, 1893.
Eastward	8,625	6,164
Westward	4,963	6,820
Totals	13,588	12,984
Decrease in eastward traffic, 1893		2,461
Increase in westward traffic, 1893		1,857
Total decrease		604

These figures show that the total volume has fallen off 4.44 per cent., the eastward movement having fallen off 28.5 and the westward increased 23.2. The result seems to be rather disappointing so far to the steamship agents, as they had anticipated a larger travel to the World's Fair, but of course had expected a diminished eastward travel. It seems probable, however, that the westbound movement will increase considerably as it becomes known that the Fair is worth coming to see, a fact which European newspapers have by no means generally admitted. Moreover, the stories of exorbitant charges for all sorts of things at Chicago have undoubtedly keptback a good many European visitors.

South American Notes.

The daily press of Peru has lately been debating the expediency of compelling the Peruvian corporation to pay the forfeit of £5,000 stipulated in the contract with the government in case of failure to complete the Central Railroad (Lima to Oroya) within three years from Oct. 25, 1889. The tone of the more important journals favors leniency toward the corporation. The government has appointed a commission of engineers to examine and report upon the condition of the line, and upon the time needed for its completion. The road has suffered many severe drawbacks within the last few years by reason of floods and other unavoidable accidents.

The new wharf of the Cartagena Terminal and Improvement Co., at Cartagena, Colombia, was formally opened on May 19. The schedule of charges for mooring alongside are graduated from $10 (Colombian currency) a day or part thereof, for vessels of 100 tons gross register, up to $50 for vessels of 2,000 tons gross register.

Dr. Mitre-Vedia, son of General Mitre, will ask a concession from the next Congress of Argentina for a canalization scheme to enable large ocean-going ships to ascend to Rosario. The plan involves the construction of a canal 18 miles long, from the Tigre to the Buenos Ayres gas works, parallel with the Rio de la Plate, beside deepening the channels of the Parana from the Tigre up to the Palmas. It would shorten the distance from Buenos Ayres to Rosario 60 miles. The plan is favorably reported upon by eminent engineers. No subsidy or guarantee is asked for.

Electric Installations in Switzerland.

From the beginning, Switzerland has been remarkable for the number and extent of its electrical installations, considering its size; and recently published statistics, reaching to the end of 1892, show that the growth of enterprise in this line has been unflagging and noteworthy in character. Comprehensive tables are published in the *Schweizerische Bauzeitung*, of April 15, which show as the most striking feature remarkable growth in the number of central stations, of which there are now, altogether, 37. Nineteen of these were put up within the past two years, and eight of this number employ the alternating system, either alone or in conjunction with continuous current systems. Power transmission plants were put up to the number of 19, but of distributing plants there was only one built since 1891. As specially noteworthy transmission plants the *Bauzeitung* mentions those of the four electric railroads between Vevey and Montreux, Sissach and Gelterkinden, Grütschalp and Mürren, and between the machine works and the station of Oerlikon. These plants have overhead transmission lines. Briefly summarized, the figures for the past few years appear as follows, the statistics for 1891 and 1892 being given together, as no separate report was made out for 1891:

	1889.	1890.	1891 and 1892.	Percentage of increase for '91-'92.
Total number of illuminating stations	351	434	562	30
Total power transmission plants	25	33	53	60.8
Total electric accumulator stations	41	73	121	65.8
Total number of dynamos and motors	536	712	1,056	48.3
Total capacity in kilowatts	7,060	13,044	20,623	34.7
Total number of incandescent lamps	51,155	68,368	115,926	69.5
Total number of arc lamps	845	1,068	1,746	63.5

The city of Berne was among the first in Switzerland to introduce electric lighting, the power for driving the dynamos being taken from the river Aare which has there a maximum fall of about 10 ft., and affords something like 400 H. P. Three Jonval turbines of 120 H. P. each are installed in the power-house, but only two of these are used for dynamo driving, while the third operates the air compressors for the Mekarski compressed air street railroad of Berne, to which reference has already been made in the *Railroad Gazette*. All three turbines transmit their power by bevel gearing to a common shaft making 125 turns per minute. Belts lead off from this shaft to the dynamos, while the compressors are driven through spur gearing. The main shaft is provided with clutches so that it can practically be divided into three sections, each to be driven independently, if desired, by its own turbine.

Close Limitation of Passes.

The Vandalia, the Chicago & Alton and the Wabash have issued circulars giving notice that from this time forward employés' and complimentary trip passes will not be good on any of the night expresses or limited day trains between this point and Chicago, and that they will be honored only on local trains. This was made necessary by the increase of passenger traffic to the World's Fair. Extra sleepers have already been put on by each line, and yesterday extra day coaches were put on. These three roads have also made new restrictions on applications for passes for other roads' employés.—*St. Louis Republic.*

Beauty and Business Intermingled.

Goldbugs from the East will be confronted, at the union depot grounds, with a gigantic silver dollar. The design is the idea of Commodore Trufaut and will be presented in living flowers with a border of beautiful green. Other floral emblems are the shield, star and an immense American flag. The grounds are in fine condition and show taste and judgment on the part of the depot authorities.—*Rocky Mountain News* (Denver).

LOCOMOTIVE BUILDING.

The Baldwin Locomotive Works are about one month behind hand with all of their work, in consequence of which the new locomotives building for the Central of New Jersey and promised for May delivery have not yet been shipped. Five of the 10-wheel engines are expected this week, the balance to follow in July.

A locomotive has just been completed at the Schenectady Locomotive Works for the use of Dr. W. Seward Webb. It is an eight-wheel passenger engine with cylinders 18×24 in., drivers of 72 in. diameter. The new locomotive is handsomely finished, and is named "Ne-Ha-Se-Ne," after Dr. Webb's park in the Adirondacks.

CAR BUILDING.

The Cumberland Valley is building 40 new box cars at its shops at Chambersburg, Pa.

BRIDGE BUILDING.

Allentown Pa.—The Commissioners of Lehigh and Northampton counties opened bids June 15 for the construction of the new iron bridge over the Lehigh River (exclusive of the spans to be built by the Lehigh Valley and Central of New Jersey railroads) at Hokendauqua. Bids were submitted on two plans—A, for 7, and B, for 6 spans. There were 17 bids for the superstructure, varying from $18,670 to $31,000 for Plan A, and from $19,950 to $34,000 for Plan B. There were 13 bidders for the masonry. No contracts will be awarded for several days.

Baltimore, Md.—The contract for the construction of the stone and brick bridge on North avenue, across Jones' Falls, was awarded last week to L. B. McCabe & Bros., of Baltimore, for $319,915.

Bridgeport, Conn.—The County Commissioners will receive bids until June 29 for a bridge over the Housatonic River.

Carlisle, Pa.—George Keefer, of Sunbury, has secured the contract to bridge the Conodoquinet at Sporting Hill with a wooden structure. His bid was $5,245.

Cleveland, O.—The City Engineer is considering the plans for the building of the Willow street and Centre street bridges in this city. Both are drawbridges over the Cuyahoga River.

Columbus, O.—The county engineer is preparing two plans for the St. Clair avenue viaduct, one providing for a 28 ft. roadway, the other for a 36-ft. roadway. One of these plans is likely to be adopted by the railroads.

Exeter Station, Pa.—The Berks County Commissioners will likely yield to public protests and erect a bridge over the Schuylkill at Green Tree Ford, about one mile above Exeter Station.

Island Brook, Que.—The Secretary of the township of Newport is calling for tenders to be received up to July 3 for building a bridge and abutments at New Mexico, Que.

Meadville, Pa.—The new bridge over Foster Creek at Gothic street is completed.

Moundsville, W. Va.—E. M. Lewis, Clerk of the County Court of Marshall County, W Va., with office at Moundsville, has asked for bids for building a steel highway bridge over Big Grave Creek, at Rosby's Rock, in that county. The bridge is to have a clear span of 70 ft., and clear width of 16 ft. Bids have also been asked for a highway bridge over Boggs Run, 40 ft. clear span, 12 ft clear width, 150 yds. excavation and 300 yds. rubble masonry for abutments.

New Martinsville, W. Va.—At a special session of the county court of Wetzel County, W. Va., the contract was let to the Canton Bridge Company, of Canton, O., for a steel bridge over Fishing Creek, at Littleton, to cost $3,000.

Norristown, Pa.—Bids were opened by the Commissioners June 15 for four new bridges, in Lower Salford, Hatfield and Moreland. There are two in Moreland, one over Huntingdon, the other over Poquessing Creek. J. Denithorne & Son were the lowest bidders on iron work for all of them. The bids were $4,595, $1,175, $975 and $875, respectively.

Plymouth, Pa.—Gratten & Jennings, of Buffalo, N. Y., have been given the contract to build the Delaware, Lackawanna & Western bridge at this point. Work will begin at once.

St. Stephens, N. B.—Major Beckwith, C. E., of Fredericton, was at St. Stephen last week making measurements in connection with the proposed new bridge.

Seymour, Ont.—Tenders will be received by the County Clerk at Coburg up to June 26 for the construction of a steel bridge across the river Trent at "The Narrows," in the township of Seymour. The bridge consists of one span of 150 ft. and a swing of 100 ft.

Stirling, N. J.—The commissioners of Morris and Somerset counties, N. J., have decided to build a new iron truss bridge across the Passaic River at Stirling, N. J.

Vail, N. Y.—A new iron bridge is to be built across the Paulinskill Creek, between Vail and Walnut Valley, N. J. It will have a 70-ft. span and a 16-ft. driveway.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston, Revere Beach & Lynn, semi-annual, 2½ per per cent., payable July 1.
Connecticut River, semi-annual, 5 per cent., payable July 1.
Fitchburg, semi-annual, 2 per cent. on the preferred stock, payable July 15.
Norfolk & Southern, quarterly, 1 per cent., payable July 10.
Norwich & Worcester, semi-annual, 4 per cent., payable July 5.
Oregon Railway & Navigation Co., quarterly, 1½ per cent., payable July 1.
Tennessee Coal, Iron & Railroad Co., semi-annual, 4 per cent. on the preferred stock, payable July 15.
Worcester, Nashua & Rochester, semi-annual, $3 per share, payable July 31.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago Junction Railways & Union Stock Yards Co., annual, Jersey City, N. J., July 6.
Marquette, Houghton & Ontonagon, annual, Marquette, Mich., July 20.
Peoria, Decatur & Evansville, special, Peoria, Ill., June 30.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Association of Railway Claim Agents* will hold its annual meeting in the Rookery Building, Chicago, July 11.

The *World's Congress of Engineers* in connection with the World's Fair will hold meetings in Chicago in the week commencing Monday, July 31.

The *American Society of Civil Engineers* will hold its summer convention in Chicago, in connection with the World's Congress of Engineers.

The *New England Roadmasters' Association* will hold its annual convention in Boston, Mass., Aug. 19.

The *American Society of Mechanical Engineers* will hold its summer meeting in Chicago, commencing July 31.

The *Western Railway Club* meets in room 730, The Rookery Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 7.30 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p.m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

Association of Engineers of Virginia.

The summer meeting will be held on June 30 and July 1, at Hotel Rockledge, on Mill Mountain, 2½ miles from Roanoke, the suggestion to this effect having been met by almost unanimous assent. The Committee on Entertainment announces that very satisfactory arrangements have been made with the hotel managers by which rates of $1.75 per day can be obtained.

Engineers' Club of Cincinnati.

At the last regular meeting of the club Mr. W. B. Ruggles read a paper on "Building Stones of the Vicinity of Cincinnati," which contained much of interest and value in information and statistics in reference to the quality and characteristics of the stones found in the quarries within a radius of a hundred miles or more from Cincinnati, and of the various uses to which they had been put and were adapted.

Mr. J. H. Lawton, who had been connected with the work, engaged the attention of the club with an interesting account of the construction of the Niagara Falls tunnel, which was built as a part of the plant of the Niagara Falls Power Co. and the Cataract Construction Co. for the utilization of the Falls for the development of hydraulic power for industrial purposes.

Local Freight Agents' Association.

The annual meeting of the National Association of Local Freight Agents' Associations was held in Milwaukee, June 14 and 15. The following officers were chosen for the ensuing year: President, J. L. Kern, Cincinnati; Vice-President, Fred Rundie, Jersey City; Secretary, L. C. Whitney, Milwaukee; Treasurer, C. H. Newton, Fort Wayne. The next annual meeting will be held in Pittsburgh.

The Traveling Engineers' Association.

The committee on economical use of oil and supplies has issued a circular containing the following questions:

1. What is your average number of miles run to one pint of engine oil? 2. What is your average number of miles run to one pint of valve oil? 3. How often do you pack driving box collars? 4. How often do you pack engine truck collars? 5. How often do you oil tender truck boxes? 6. How often do you clean tops of driving boxes and engine truck boxes? 7. Do you use sight feed cylinder lubricators? 8. Do you use automatic oil cups on side and main rods, eccentric straps and guide bars? 9. What kind of oil feeder, if any, do you use on top of driving boxes and engine truck boxes?

10. How do you treat extravagant use of oils and other supplies? 11. Do you place a limit on the amount of oil used per 100 miles? 12. Do you place a limit on the amount of waste per 100 miles? 13. What other supplies do you place limit on? 14. Who draws the oil and supplies, and on whose requisition are they furnished? 15. Do you consider it good policy to limit the amount of supplies to be used per 100 miles?

16. Do you keep inventory of tools and equipment on each engine? 17. When are inventories made out, and by whom? 18. How do you treat shortage of tools and equipment? 19. What is your idea of the best way to economize in the use of oil and other supplies? 20. Can your engineers keep record of amount of oil they use from day to day? If so, what plan is followed? 21 What is your allowance in pints per 100 miles of all kinds of oil, and ounces of waste? 22. Does your company pay a premium to the engineer and fireman running engine the most economically?

The Committee consists of M. M. Meehan, Chairman, 221 West Ridge street, Marquette, Mich.; J. S. Bauder, Collinwood, O., and W. E. Miller, Terre Haute, Ind.

Members are requested to send copies of blank forms that will give light on the subject, and in answering not to confine themselves to the printed questions. Replies should be sent to the Chairman by Aug. 1.

The Committee on using engines "double crewed or pooled" asks replies to the following questions:

1. Do you double crew, pool or chain gang engines on your line? If so, state which of the systems you are working. 2. By whom are engines examined, and who is held responsible for the proper inspection of same, reporting on roundhouse repair book work needed on the engine before next trip? 3. Are engineers or machinists employed at terminals to inspect engines on arrival? 4. What system do you use to keep engines properly supplied with tools and lamps? 5. Do you employ engineers to do packing and trimming in roundhouse? 6. Do your firemen do any cleaning on pool engines, or is it done in the shop? 7. Are engineers notified before going out if any new bushings, brasses or wheels have been put in? 8. Is work done to engines irrespective of the stations to which they belong? 9. On double-crewed engines, do you try to place men on opposite turns on same engine that are friendly and work in harmony with each other? 10. What is the average mileage of engines before going to shop? 11. Have you a code of rules on your road to govern the pool system? If so, please furnish a copy of same.

The committee consists of W. T. Simpson, Chairman, 55 Bennett street, Battle Creek, Mich.; W. J. Anthony, Escanaba, Mich.; J. W. Sheldon, Renovo, Pa.; W. T. Hamar, Atlanta, Ga.; D. R. McBain, St. Thomas, Ont.

Yard Masters' Association.

The Railway Yard Masters' Association held its annual meeting at Duluth, Minn., June 15 and 16. A new constitution was adopted and it was decided to hold next year's meeting at Peoria, Ill. The following officers were elected for the ensuing year: President, J. W. Coneys, Cincinnati; Vice-President, J. McNaught, West Superior; Secretary and Treasurer, O. O. Winter, Minneapolis.

PERSONAL.

—Mr. George T. Utley, Secretary of the Connecticut State Board of Railroad Commissioners, died of heart disease at Hartford, Conn., this week. He had been Secretary of the Board for twenty years.

—Mr. C. E. Wurtele, Superintendent of the Wyoming Division of the Union Pacific Railroad, died in Philadelphia this week of dropsy. Mr. Wurtele had been with the Union Pacific since 1868, beginning as a telegraph operator.

—Mr. T. F. De Garmo, who has been for nearly three years the general agent of the Trojan Car Coupler Co., of Troy, N. Y., has accepted a position with the Glidden & Joy Varnish Company, of Cleveland, O., and will have his headquarters at New York City.

—Mr. James Parks, one of the organizers of the Steubenville & Indiana Railroad in 1868, and who was for 34 years a director in the Pittsburgh, Cincinnati & St. Louis, died at Steubenville this week. For 13 years he was the only surviving member of the original Board of Directors of the company.

—Mr. William E. Green, Vice-President and General Manager of the Griffin Car Wheel Co., of Chicago, will, it is reported, become General Manager of the Cincinnati, Hamilton & Dayton Railroad, with headquarters in Cincinnati, on Aug. 1. Mr. Green was formerly General Manager of the Cleveland, Cincinnati, Chicago & St. Louis Road.

—Mr. Horace W. Eddy, Division Master Mechanic of the Boston & Albany, at Springfield, Mass., has resigned to take effect July 1. He will be succeeded by Mr. Charles Barnes, who has for several years been chief air brake inspector of the road. Mr. Eddy is a son of Wilson Eddy, the well known Master Mechanic of the road from its earliest years until 1880.

—Mr. Virgil G. Bogue, M. Am. Soc. C. E., has opened an office as Consulting Engineer at 18 Broadway, New York, and at the Rialto Building, Chicago, and is prepared to make reports on railroad properties and water works, irrigation and sewage systems. Mr. Bogue is favorably known to the railroad world from his long connection with the Union Pacific and the Northern Pacific. He resigned as Chief Engineer of the Union Pacific in February, 1891.

—Dr. W. T. Barnard, who has been President of the Chicago & South Side Rapid Transit since it was opened, has been granted a leave of absence until Oct. 31 next on account of ill health, and it is reported that he will then resign as President of the company. Vice-President Arthur Wheeler will be Acting President; he is a brother of Mr. C. C. Wheeler, President of the Chicago City Railway Co., which operates the South Side cable lines in Chicago. Mr. Marcellus Hopkins, at present Division Superintendent of the Chicago & Northwestern, has been appointed General Manager of the elevated road and will have charge of the operating department.

—Mr. John Whitmore, General Traffic Manager of the Fitchburg Railroad, died in Boston on June 21, aged 53 years. From 1854 to 1865 he was employed on the Midland Railway in England, and was then appointed Division Superintendent of the Glasgow & Southwestern Railway of Scotland. He went to Canada in 1866, and was employed on the Grand Trunk until he became General Agent at Buffalo. He was also General Manager of the International Fast Freight Line from 1871 to 1878; later agent for the Blue Line at Kansas City, and General Manager of the Commercial Express Fast Freight Line at Chicago. In 1882 he was appointed Traffic Manager of the Fitchburg, and General Traffic Manager in 1887. He has been in ill health for some months past.

—United States Senator Leland Stanford died at his residence at Palo Alto, Cal., on June 20. Mr. Stanford was born in Watervliet, N. Y., in 1824, and in 1849 he was admitted to the bar. In 1852 he started for California, where he soon became interested in gold mining, with his three brothers. He settled in San Francisco in 1856 and engaged in mercantile business, soon amassing a large fortune. When the Central Pacific Railroad was organized in 1861 he was chosen President, and had ever since retained that title. In 1861 he was elected Governor of California, serving through 1862 and 1863. He superintended the construction of the Central Pacific road, the first transcontinental road, driving the last spike at Promontory Point, Utah, on May 10, 1869. Later on he became interested in other railroads on the Pacific Slope. He was President of the Southern Pacific Co. from 1884 to 1890, and on Mr. C. P. Huntington's election to the latter office he became Chairman of the Executive Committee. Senator Stanford's estate is valued at over $50,000,000.

—Mr. Henry Villard's resignation was accepted at a meeting of the Northern Pacific directors on June 21. The position of Chairman of the Board was abolished, it being determined that the President should serve in that capacity in the future, and John D. Rockefeller was

elected a director in Mr. Villard's place. President Oakes said: "On March 1 last Mr. Villard handed his resignation to me, requesting that it be submitted to the Board of Directors. I requested him to hold the matter in abeyance until the floating debt could be provided for. This now being accomplished by the actual formation of a guarantee syndicate of which Mr. Villard and his friends took more than one-half among themselves, he now insists upon his resignation being accepted, believing that he is now justified in taking a long rest and traveling abroad. Mr. Villard's services have been of great value to the Northern Pacific Company, and they are appreciated by every member of the Board, and it is with great pleasure that I can say he retires from the official service of the company with a most cordial and friendly feeling on all sides.

—Mr. Walter McQueen, formerly and for many years Superintendent of the Schenectady Locomotive Works, died in Schenectady, N. Y., on June 16. He was Vice-President of the works at the time of his death. Mr. McQueen was born in Scotland in 1817, but came to this country in 1830 with his parents. He served his apprenticeship in a machine shop in Albany, and in 1838 was engaged with Eaton & Gilbert, of Troy, the original firm of the present Gilbert Car Co. For three or four years he was locomotive engineer on several roads in New York state, and in 1845 became Master Mechanic of the Mohawk & Hudson, reorganized as the Albany & Schenectady, and remained with that company five years. In 1852 he left the railroad service to accept the position of Superintendent of the Schenectady Locomotive Works, which he held until 1876, resigning at that time to become Vice-President of the company. Mr. McQueen was the originator of a large number of valuable improvements on locomotives, on none of which, however, he made any effort to secure patents. While Superintendent of the Schenectady Lomocotive Works over 1,000 locomotives of various designs were built under his snpervision.

ELECTIONS AND APPOINTMENTS.

Central of New Jersey.—George I. Stanton has been appointed District Passenger Agent in charge of the New Jersey Southern District, vice Amzi T. Dodd, transferred to other duty. Mr. Stanton's office will be at Long Branch.

Central Railroad & Banking Company of Georgia.—J. P. Beckwith has been appointed General Agent of this company, with headquarters at No 13 South Third street, Philadelphia, Pa., vice James Willetts, Agent, resigned, the appointment to take effect July 1.

Choctaw Coal & Railway Co.—Ex-Governor Throcmorton has been appointed Receiver of this road to succeed E. Chadwick, who recently resigned. He is to act with Francis I. Gowen, who continues as Joint Receiver.

Cleveland, Cincinnati, Chicago & St. Louis.—The office of William Garstang, Superintendent of Motive Power, has been removed from Cincinnati to Indianapolis.

Delaware, Lackawanna & Western.—George N. Hallstead, Treasurer of the Buffalo Car Wheel Works, has been appointed General Train Master of this road, with headquarters at Scranton, Pa.

Great Northern.—J. W. Deans, for the past three years Contracting Freight Agent of the San Antonio & Aransas Pass road, at 373 Broadway, New York, has been appointed to a similar position with this company, with headquarters at 375 Broadway, New York.

Gulf, Colorado & St. Paul.—M. W. Wambold, assistant chief engineer of the road, has tendered his resignation. Mr. Wambold has been in the employ of the company for about three years. The position he has held is to be abolished.

Jacksonville Southeastern.—C. A. Henderson, who has been Acting General Superintendent since the resignation of D. W. Rider last fall, was last week appointed General Superintendent, with headquarters at Jacksonville, Ill.

Kansas City & Atlantic.—The first directors of this company are: Francis Amory, L. M. Crosby and E. W. Burdett, Boston; W. T. Burns, Baltimore; W. S. Walcott, New York; T. A. Burns, Connecticut; J. J. Harrison, Dover, N. H.; A. C. Paine, Portland, Me.; Stephen Solmsby, Worcester, Mass.; C. Bates, Walton H. Holmes and Thomas R. Morrow, Kansas City.

Macon Construction Co.—The annual meeting of this company, which built the Georgia Southern & Florida, was held at Macon, Ga., last week. The following directors were elected: H. J. Lamar, Sr., A. Proudfit, W. G. Solomon, H. C. Tindall, John Ingalls, B. L. Willingham, W. W. Collins, A. B. Small, W. G. Smith, H. J. Lamar, Jr., M. Nussbaum, George B. Jewett, C. W. Hendrick. The following officers were elected: A. Proudfit, President; A. B. Small, Vice-President; Henry L. Jewett, Secretary and Treasurer.

Maine Shore Line.—The annual meeting of the company was held at Machias, Me., last week. The following board of directors was elected: S. D. Leavitt, of Eastport, Me.; L. G. Downes, A. McNichol, J. S. Clark, of Calis; William M. Nash, Samuel N. Campbell, of Cherryfield; John K. Ames, of Machias; Austin Harris, Austin F. Kingsley, of East Machias; George M. Hanson, of Calais; B. B. Murray, of Pembroke.

Monongahela River.—T. J. Cole has resigned the position of Trainmaster of the railroad. O. J. Sands has resigned the position of Treasurer of the same road, the position being taken by J. E. Sands.

New Cumberland & Pittsburgh.—The directors are as follows: John E. Davidson, Pittsburgh, President; James McCrea, J. J. Brooks, John W. Renner, William Mullins, A. McElevy, S. C. Scott, Pittsburgh.

New York, Texas & Mexican.—J. G. Garrick, foreman of the shops at Cuero, Tex., is the new Division Master Mechanic at Victoria, Tex. He succeeds James Mooney, resigned.

Quincy, Omaha & Kansas City.—The following directors have been recently elected: Charles H. Bull, Amos Green. H. F. J. Ricker and James D. Morgan, of Quincy, Ill.; John Paton, of New York; Ward W. Jacobs, of Hartford, Conn.; and Geo. R. Balthrope, of Edina, Mo

St. Louis, Chicago & St. Paul.—Joseph Dickson and Charles A. Kimball, recently appointed Receivers of this road, have issued notice of the present organization of the company. The only important change in the list of officers is the appointment of Elenious Smith, formerly Secretary, to be Solicitor, and of Ralph Blaisdell to be Auditor, vice A. C. Wells, Acting Auditor.

Southern California.—General Manager K. H. Wade announces that the general freight and passenger departments of this road have been separated, and the following appointments are now effective: S. B. Hynes, General Freight Agent; T. A. Whitmore, Assistant General Freight Agent; H. G. Thompson, General Passenger Agent, and H. K. Gregory, Assistant General Passenger Agent, all with headquarters at Los Angeles, Cal.

Toledo, Ann Arbor & North Michigan.—At a meeting of the directors at Toledo, O., June 19, the following New York capitalists entered the directory to fill vacancies: John Jacob Astor, J. Edward Simmons, George W. Quintard, Amos F. Eno, Jos. Walker, Jr., H. B. Livingston and E. Dichman. These changes are the result of an agreement reached by the bondholders' committee.

Winona, Osage & Southwestern.—The annual meeting of stockholders of the company was held at Osage, Ia., June 14. The following board of directors was elected: H. W. Lamberton, V. Simpson, C. Horton, R. D. Cone, Andrew Hamilton, E. S. Yeomans and J. L. Norton.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Abbeville Southern.—The contract for grading and tracklaying on the railroad from a point three miles from Dotham, Ala., on the Alabama Midland, to Abbeville, Henry County, 27 miles, has been let to S. G. Pruitt, of Montgomery, Ala., the line to be finished by Jan. 1, 1894. The building of this road will open up a fine agricultural section of the State. It will be operated by the Plant system. Col. B. Dunham, of Montgomery, is the Chief Engineer.

Altoona & Phillipsburgh Connecting.—The grading on the northern end of the line is now about completed between Phillipsburgh and Osceola, and the greater part of the heavy work between the latter town and Ramey is also completed. Ties are now being delivered and much of the track between these points will be down by July 1. The road will be about 20 miles long from the Beech Creek road at Phillipsburgh to Janesville, a town near Altoona, Pa. The road is being built by Samuel P. Langdon, of Philadelphia, who owns valuable coal lands in the territory to be traversed by the new road. Mr. Langdon has secured control of the Altoona, Clearfield & Northern, with which the new road connects at Janesville.

Bangor & Aroostook.—The rails have been laid on the road from Brownville Junction, Me., across the temporary bridge that spans Pleasant River, and for about two miles up the east side. Construction trains run to that point carrying materials. One thousand men are at work, scattered along the line of the new road between Brownville and North Twin dam on the West Branch of the Penobscot River. Supplies and materials are drawn by teams to Schoodic Lake, a distance of six miles, and then by steamer to the head of the lake, 12 miles, and thence sent either way as needed.

Burlington & Missouri River.—The Montana and Wyoming newspapers print numerous reports concerning the extension of the northwestern branch of this road beyond its present terminus at Sheridan, Wyo. Kilpatrick Bros. & Collins are reported to have sent forward from Sheridan within the last few weeks large quantities of construction material and over 350 teams. They state that many sub-contracts have been let and that work is now going on betweeen the Tongue River near Sheridan and the Montana state line, the grading outfits being those of contractors Sharp, Delaney, McShain and McDonald Bros.

Burrard Inlet & Fraser Valley.—President Charles D. Rand announces that he has completed arrangements for the immediate construction of the road. He has invited tenders for the first section of the road from Vancouver, B. C. The southern terminus of the road will be at Sumas, Wash., and the distance between the two towns is 52 miles. The chief contractors are Dickinson & Co., of Tacoma, Wash.

Chesapeake & Ohio.—The junction of the branches of the Kanawha & Michigan and Chesapeake & Ohio now building will be formed in the Kanawha Valley, W. Va., within a few days after July 1. Through trains, both east and west, will be running on a new joint schedule before July 15 The tracklaying on the Kanawha & Michigan has been completed to Gauley River, the terminus of that line. The Kanawha & Michigan bridge over Gauley River and the Chesapeake & Ohio bridge over New River are both completed, and the only remaining work to be done is the laying of the short piece of track between the two bridges, which will take less than two weeks. The Chesapeake & Ohio is pushing its road along New River, and has 12 miles of it now completed, and will have 15 miles ready for locomotives by July 1. A heavy force is at work on the grade of the line up Twenty Mile Creek which will connect at the mouth of Gauley River.

Last week the work of arching the Big Bend tunnel on this line, in Summers County, W. Va., with brick, was completed. This job was commenced over twelve years ago, and has been carried on almost constantly ever since.

Chicago, Indiana & Eastern.—The contract for construction work on this road from Fairmount, Ind., to Muncie, Ind., a distance of 26¼ miles, has been let and this section will be built at once. When that is completed the officers expect to build northwest, passing through Swayzee on the Toledo, St. Louis & Kansas City, Converse and Amboy to Peru, Ind. The contractors are the Schafer, Nichols, Watkins Co., of Louisville, Ky. The work is all light and the maximum grade is 15 ft. to the mile. The only bridge of the present contract is across the White River at Muncie. F. A. Root is President; W. M. Nichols, Secretary, and D. G. Seymour, Chief Engineer. The headquarters are at Fairmount, Ind.

Denver, Longmont & Noland.—The final survey and cross sectioning are now in progress. The bonds to the amount of $250,000 have been placed in Chicago, and Norman W. Gifford, of Chicago, has taken the contract to build and equip the line ready for operation. He is now in Colorado letting the sub-contracts. The line is 13 miles long, extending from Longmont to Noland stone quarries and will be equipped with 25 flat cars, one caboose and one engine. The Union Pacific has virtually controlled the output of Noland and is reported to have brought out 11,000 cars last year. The officers are Geo. W. Skinner, President; E. R. Perkins, Treasurer; S. A. Williams, General Manager; L. H. Quimby, Secretary; Chas. Bradt, Engineer. The headquarters are in Denver.

Dominion Coal Co.—This company is calling for tenders for the grading and masonry of that portion of the company's railroad in Nova Scotia extending from a point near Caledonia Mines to a point near the Back Ladds Road, in length about nine miles, and also a branch to the Gowrie Mines, about one mile.

Duluth, Missaba & Northern.—The work of grading and bridging the main line from near Stony Brook Junction, Minn., to Duluth is nearly completed. There have already been laid 12 miles of track—about one half the entire distance. Messrs. Wolf & King, who have the contract for this work, are also building the extension to the Superior mine. The grading on this line is about half done, and the work is being pushed in order that the line may be ready for operation on Aug. 1. The company will soon let the contract for a two-mile branch to the McKinley mine, also for several short spurs. C. H. Martz, of Duluth, Chief Engineer of the road, has charge of all this work.

Everett & Monte Cristo.—It is expected that this road will be opened for traffic to Silverton, Wash., by July 1, and to Monte Cristo, Wash., which will be the terminus of the road, and is 12 miles beyond Silverton, during the summer. Trains are now running on the western end of the road between Everett and Lowell, Wash., and to the first crossing of the Stillaguamish River.

Hodgenville & Elizabethtown.—The right of way for the extension of the road from Hodgenville, Ky., its present terminus to Scottville, where it will connect with the Chesapeake & Nashville, is nearly all secured by President Hubbard.

Iola & Northern.—This railroad is being built from a connection with the Green Bay, Winona & St. Paul northeasterly through Waupaca County, Wis., for about 25 miles. The connection with the Green Bay road is made at Scandinavia, a small town east of Stevens Point, Wis., and the line has been graded for six or eight miles from that town to Iola. The tracklaying will begin this week. McIntosh Bros., of Milwaukee, are the contractors.

Jacksonville, St. Augustine & Indian River.—This line is now in operation as far as Eau Gallie, Fla., 15 miles south of Rockledge. The entire extension of 125 miles from Rockledge to Lake Worth is being pushed very rapidly, the grading being completed to below the Sebastian River, 25 miles south of Eau Gallie. A force is also grading from Lake Worth, north. Jno. D. Maclennan, of Toronto, is the contractor, his present headquarters being at Eau Gallie, Fla. Charles O Haines is Chief Engineer.

Kansas City & Atlantic.—Articles of incorporation were filed in Missouri last week, and the charter states that the company is organized to construct a line 200 miles in length, from the town of Calnesville, Harrison County, to a point on the Chicago, Kansas City & Texas Railroad, near the town of Smithville, and thence to a point near Kansas City. The company will control the Chicago, Kansas & Texas, the Kansas City, Bridge & Terminal Company, which owns the partially completed bridge over the Missouri River at Kansas City, and others of what are called the Winner enterprises. The directors of the new company purchased these properties at foreclosure sale last spring. It is said that if Congress eliminates the free wagon bridge clause from the charter of the bridge, the structure will be completed. Theodore C. Bates, of Worcester, Mass., is President of the new company.

Kansas City, Pittsburgh & Gulf.—The southern extension of the line which has been building during the last fall and winter is now completed as far as Pittsburgh, Kan., and it was opened to that point on June 10. Pittsburgh is about 40 miles south of Hume, Mo. Work is now in progress on the line from Pittsburgh to Joplin, Mo., about 25 miles, to connect the main line with the Splitlog division, formerly the Kansas City, Fort Smith & Southern, which is now operated by this company.

Kansas, Oklahoma Central & Southwestern.—This company was recently organized in Arkansas City, Kan., by Judge Robert Martin, of Guthrie, Okla.; J. R. Clark and R. A. Lowry, of Stillwater; C. L. Severy, of El Reno; W. H. Conner, of Osage; S. M. Porter and R. C. Hollingsworth, of Caney; V. C. Prasure, of Coffeyville, Kan., and others. It is proposed to build a line of railroad from Stevenson on the Missouri, Kansas & Texas road in the Cherokee Nation through the counties in Oklahoma and thence through Indian reservation to Vernon, Tex.

Lithia Springs.—A charter was granted to this company in Georgia last week to build a road from a point in Atlanta to the Chattahoochee River, near the southern boundary of the county, and thence to Lithia Springs. The principal incorporators are B. F. Curtis and Thomas Camp, of Atlanta.

Mexican & Northern Pacific.—Huss, Townsend & Company, of Chicago, who are the general contractors for building this road into Northern Mexico, report that the rails for that portion of the line already graded are expected to arrive in this country from England in about 30 days and that the tracklaying will then begin. The northern terminus of the road is at Deming, N. M., and the line has been graded and bridges built south of that town for about 80 miles to a point in the state of Chihuahua, Mex. The contractors have over 130,000 ties delivered at Deming ready to be distributed along the graded roadbed.

Midland Terminal.—The construction work on this line to the Cripple Creek mines is reported to be at a standstill at present. It is a narrow gauge line from Divide Station on the Colorado Midland to Cripple Creek, Col., and has been graded to the new town of Midland, about eight miles. The bridges have been built for this distance, masonry work completed and ties and rails distributed along the line. The work was originally started by the Colorado Midland, and the line located into Cripple Creek. The franchise was transferred to this company which expects to complete the work into Cripple Creek. The road is narrow gauge, but a third rail will be laid from Divide as far as Midland. R. Newell, Jr., is Manager and Chief Engineer.

New Cumberland & Pittsburgh.—This new branch road, which was incorporated in Pennsylvania last week, will be 16 miles long and is destined to be a connecting link between the Panhandle and Pittsburgh, Fort

Wayne & Chicago roads. It is an extension of the Panhandle and will extend along the south bank of the Ohio River, through the townships of Green, Raccoon and Moon, in Beaver County, to a point on the Pittsburgh & Lake Erie in Philipsburg, Beaver County. The bridge across the Ohio near Philipsburg can be erected at a moderate cost.

New Hamburgh & Poughkeepsie Connecting.—The company filed a charter in New York this week. It is proposed to construct a standard gauge steam road, about 12 miles in length, from the New York Central Railroad at New Hamburgh to and through Wappinger's Falls to the Poughkeepsie & Eastern road in Poughkeepsie, and to the Philadelphia, Reading & New England in Poughkeepsie. The directors are: William H, Sheldon, G. O House, A. B. Gray, Myron H. Barlow, Homer E. Briggs, Jay Harcourt and John P. Wilson, of Poughkeepsie, and Whitfield H. Sheldon, of Goshen, N. Y.

New Roads.—Maj. B. M. Temple, of Houston, Tex., has just finished surveying the route for a railroad to be built by Cunningham & Miller from their sugar plantation to Arcola, Tex., a distance of about 12 miles. This road will connect with the International & Great Northern and the Gulf, Colorado & Sante Fe and is being built to transport the products of the sugar refinery. It is understood that the road is to be completed in the fall.

Norfolk & Western.—This company has a large force of men at work on the Ohio River extension of its line, putting in new ballast and otherwise generally improving that division. This division will be ballasted throughout with broken stone.

Ohio Southern.—The engineers who began a preliminary survey north of Lima, O., early in June are reported to have completed their reconnaissance to Toledo, and have forwarded their report to President George W. Saul.

Pennsylvania.—Track laying on the Chestnut Hill extension of the railroad, from the junction, below Chestnut Hill, to the connection with the Trenton Cutoff Railroad at Fort Washington, Pa., is about completed, and the road will soon be ready for train service. Temporary stations will be erected, and, it is said, passenger trains will be run over the road in July.

Pittsburgh, Cincinnati, Chicago & St. Louis.—Tracklaying has been resumed on the New Cumberland, W. Va., extension of this road at Tomlinsons' Run, where it was delayed several weeks while a steel bridge of 100-ft. span was erected over that stream. The work is now progressing rapidly, and the road will be ready for trains as far as Kenilworth by July 1.

Pueblo, Gunnison & Pacific.—Carlisle & Weitbree, of Pueblo, Col., have it is reported, been recently awarded the contracts for building this road in Colorado. The last surveys for the line were made in 1890 by H. R. Holbrook, of Pueblo, down the Arkansas River.

St. Louis Merchants' Bridge Terminal.—J. A. Ware, of St. Louis, who was recently awarded the contract for an extension of this line, has over 700 men and 150 teams at work on the construction. The line now being graded is to commence in North St. Louis, and will extend west and south to Carondolet, Mo., a distance of 12 miles. The line is to be a double-track belt railroad and will have no grade crossings, all the crossings of streets and railroads being above or under grade.

Wilmington & Weldon.—Contracts were let on June 20 for the Manchester & Augusta extension from Remini, S. C., to Denmark, S. C., 140 miles. Watkins & Harlow, of Birmingham, Ala., were awarded the contract for all trestle-work, including the long trestle at the Santee River, which is three miles long. Moorman & Co., of Lynchburg, Va., have the grading. The contract for the other bridge-work has not yet been awarded. There were over 30 bids on grading and trestle-work; all the work is to be completed by Jan. 1 next.

Winchester & Beattyville.—A branch about a mile long is now being built to coal mines near Beattyville, Ky., and other branches to coal mines in the vicinity are contemplated. It is proposed to change the name of the company to the Beattyville & Cumberland Gap shortly, and it is expected to build up the middle fork of the Kentucky River toward Pineville and Cumberland Gap, Ky. The road now in operation is about six miles long.

Woodstock & Centreville.—The annual meeting was held at Woodstock, N. B., recently, and it was decided to go ahead with the construction work as soon as possible. The contract has been let to Lawlor, Connor & Co. The heavy work on the road has been delayed owing, among other reasons, to the failure to secure the right of way. The road will extend through a fertile and well populated district, just east of the Maine state line. It will be 15 miles long from the connection with the New Brunswick road at Woodstock north to Centreville, and the line may be extended to the Maine state line near Bridgewater.

GENERAL RAILROAD NEWS.

Boston & Albany (Georgia).—Judge Speer, of the United States Circuit Court, at Macon, Ga., last week appointed Marshall Frank Leverett temporary receiver in a suit begun by stockholders of the Quitman Lumber Co., in which charges of mismanagement were made against President J. N. Pidcock and the present officers. The road is about 55 miles long, extending from Pidcock to Moultrie, Ga. It was originally built as a tramway by the Quitman Lumber Co., and then incorporated under a special charter and opened for general railroad business.

Findlay, Fort Wayne & Western.—This company has filed amended articles of incorporation in Ohio, increasing its capital stock from $3,090,000 to $3,490,000.

Mobile & Girard.—The trustee of the bondholders of the railroad last week filed a petition in the United States court at Montgomery, Ala., to foreclose the mortgage of $1,000,000 on bonds issued in 1877. Of these bonds $800,000 bear interest at four per cent. and $200,000 at six per cent.

Ohio & Mississippi.—The committees of shareholders announces that over 85 per cent. of the Ohio & Mississippi general mortgage 5 per cent. bonds and the junior securities of the Ohio & Mississippi and Baltimore & Ohio Southwestern railroads have been deposited under the plan of reorganization. The committee also announces that it is prepared to receive deposits of the Ohio & Mississippi first and second mortgage consolidated 7 per cent. bonds, and first mortgage 7 per cent. Springfield Division bonds. Under the plan of consolidation holders of these bonds will be entitled to receive in exchange for their bonds new 4½ per cent. first consolidated mortgage gold bonds.

Philadelphia & Reading.—The success or failure of the request to the stockholders and bondholders for the deposit of their securities, under the terms of the reorganization plan, was still doubtful on June 21, the last day on which the securities could be deposited. It is believed that the required 90 per cent. of bonds and stock has not been deposited, and the rehabilitation scheme will fail unless the time for receiving deposits is extended, and the underwriting syndicate is unwilling to take that action. At 4 o'clock on June 21, it was announced that the total assents to the plan of rehabilitation then amounted to $30,389,000 bonds and 381,600 shares of stock. There seems every reason to believe that the total amount of bonds assented will fall short of the required $41,828,000 by several millions of dollars.

Richmond & West Point Terminal.—Two changes have been made in the reorganization plan. East Tennessee, Virginia & Georgia improvement and equipment bonds are to receive 75 per cent. in bonds preserving their present lien, bearing interest at four per cent. for five years from March 1, 1893, and at five per cent. thereafter, and 50 per cent. in preferred stock, also $25 in cash on completion of the reorganization. Columbia & Greenville first and second mortgage bonds receive the same terms as Georgia Pacific first and second mortgage bonds. The Reorganization Committee has taken another important step, and has fixed a time limit, July 8, for depositing several securities of leased roads.

St. Louis, Chicago & St. Paul.—The Receivers appointed under the order of the Illinois Circuit Court at Springfield, Ill., last week are Joseph Dickson, the former Receiver of the company and recently its Secretary and Charles Kimball, of New York City, President of the company, the appointment being made on petition of the Atlantic Trust Co., of New York.

Seashore (Washington).—The transfer of the property of the Astoria & South Coast Railroad to the above company was reported at Astoria, Or., last week. The transfer includes the completed road from Astoria to Seaside, Or., about 16 miles, rolling stock, etc., and the partly graded road south of Astoria. The new company has issued bonds to the amount of $48,000. The company was incorporated last May with a capital stock of $175,000. D. K. Warren is its President and J. Q. A. Bowlby is Secretary.

Union Pacific.—The statement of earnings for April shows a gross decrease for the system of $63,427, and with an increase of $35,597 in expenses the result is a net decrease of $99,424. The net decrease of the system for four months is $305,884. The detailed statements of the system and of some of the divisions are printed below:

OREGON SHORT LINE & UTAH NORTHERN.

Month of April:	1893.	1892.	Inc. or dec.
Gross earnings	$615,128	$553,237	I. $61 891
Oper. expenses	364,574	370,856	I. 6,282
Surplus	$250,554	$182,381	I. $68,173
Since Jan. 1:			
Gross earnings	$1,941,367	$2,041,133	D. $99,966
Oper. expenses	1,285,472	1,367,163	D. 81,090
Surplus	$655,695	$673,970	D. $18,275

UNION PACIFIC, DENVER & GULF.

April:			
Gross earnings	$422,292	$417 442	I. $2,850
Oper. expenses	381,911	359,075	I. 2 —
Surplus	$40,380	$58,367	D. $17,986
Since Jan 1:			
Gross earnings	$1,809,102	$1 688,226	I. $120,875
Oper. expenses	1,450,398	1,426,270	I. 24,128
Surplus	$358,703	$261,956	I. $96,747

UNION PACIFIC SYSTEM PROPER.

April:			
Gross earnings	$3,030,888	$3,083,385	D. $52,996
Oper. expenses	2,202,060	2,202,811	D. 741
Surplus	$828,818	$881,073	D. $52,255
Since Jan. 1:			
Gross earnings	$11,889,497	$12,060,369	D. $170,872
Oper. expenses	8,530,903	8,483,707	I. 47,195
Surplus	$3,358,594	$3,575,662	D. $218,068

GRAND TOTAL OF UNION PACIFIC SYSTEM.

Month of April:			
Gross earnings	$3,154,814	$3,218,241	D. $63,427
Oper. expenses	2,338,033	2,302,036	I 35,997
Surplus	$816,780	$916,205	D. $99,424
Since Jan. 1:			
Gross earnings	$12,393,871	$12 656,945	D. $263,073
Oper. expenses	8,922,091	$8,879,280	I. 42,811
Surplus	$3,471,780	$3,777,665	D. $305,884

TRAFFIC.

Traffic Notes.

The Boston & Albany has made a slight reduction in World's Fair rates, the round trip fare from Boston to Chicago by the slower trains having been reduced from $35.20 to $32.

The Western & Atlantic has established a through train of vestibuled cars between Atlanta and Louisville. It has through sleeping cars to Chicago. It is called the "Velvet train," and runs over the Nashville, Chattanooga & St. Louis, and the Louisville, New Albany & Chicago. The time through from Atlanta to Chicago is 23 hours.

The three ships of the Pacific Mail Steamship Co. running between New York and Colon have been leased for a year to the line running in connection with the Panama Railroad, in accordance with the plan heretofore announced.

Commissioner Hill, of the Colorado Demurrage Bureau, reports that the number of cars (carload lots) of freight received in Denver for the first five months of this year, exclusive of live stock, has been 89,744, an increase of 11,008 over the same period of last year.

The New York papers report that the Canadian Pacific has reduced freight rates from New York to San Francisco this week to the basis of $1.82 per 100 lbs., which is about 10 per cent. below the rates of the Southern Pacific. The lower classes and commodity rates seem not to go below $1, however. It does not appear, however, that the Canadian Pacific gets much freight.

The Pennsylvania and Reading roads have agreed to raise the rates of fare from Philadelphia to seashore points in New Jersey. Beginning July 1 the fare from Philadelphia to Atlantic City will be raised from $1 to $1.25; the round trip rate will be $1.75 instead of $1.50, and to Cape May it will be $2.25 instead of $2. The distance to Atlantic City is 64 miles, so that the rate of fare is still less than two cents a mile.

The half-fare excursions from Cincinnati and Louisville to Chicago last week were not well patronized. The railroad men say that this shows that the people are not yet ready to take their Chicago vacations, and that, therefore, low fares are not demanded or justified; but other people say that the difficulty is in the four-day limit, which makes the time available at the Fair unreasonably small. Probably the latter is true.

At a meeting of the St. Louis Car Service Association last week the rules governing the delivery of grain in cars were somewhat modified. It was resolved to enforce the rules as published as to elevator companies acting as the agents of the consignees, in the same manner as the rules relating to commodities other than grain are enforced on local delivery. The rules relating to re-consignment were changed, so that instead of 48 only 24 hours would be allowed without charge on an initial line, and then if the car should be re-consigned a charge of $1 a day is to be assessed, agents to collect before accepting an order to forward the car, thus insuring the final consignee the full 48 hours allowed for unloading. The $1 charge, however, is not to apply where the removal is to a private siding of the initial line or to another place of business of the original consignee.

Chicago Traffic Matters.

CHICAGO, June 21, 1893.

The Federal Grand Jury, acting upon information and testimony presented by the Interstate Commerce Commission, have indicted G. B. Spriggs, General Freight Agent of the Nickel Plate, for violation of the Interstate Commerce law by the payment of rebates and concessions to shippers. An attempt was made to secure the indictment of some of the passenger officials for having made payments of commissions and for furnishing tickets to ticket brokers at less than published rates, but the brokers declined to present their books, on the ground that, while they might be protected under the Interstate Commerce act, they would be liable under the law of Illinois. The Grand Jury have asked the court for an order compelling the production of books and papers, and the motion will be argued before Judge Grosscup this week. In view of the claim of the brokers that the Illinois law is unconstitutional, their defense in the present cases is somewhat peculiar. The indictment found against Mr. Spriggs two years ago still hangs over his head, no settlement of the case ever having been reached.

A meeting of general passenger agents of eastbound lines is in session to-day considering differential rates eastbound and questions growing out of the awards of the arbitrators on the subject of excess fares on fast trains.

Now that it is apparently settled that the Exposition will remain open Sundays, it is probable that the Chicago lines will favor the running of cheap excursions from territory within a radius that can be easily reached on a limit which will allow passengers to spend Sunday in the city, returning the same night.

The Burlington on June 18th put on a new train with through service between Chicago and Houston, Tex., in connection with the Missouri, Kansas & Texas; also one additional through train daily to St. Paul and one to Kansas City.

Wool rates are now quoted at $1.05 per 100 lbs. from Pacific coast points to Atlantic seaboard points.

Central Traffic lines have voted to make a half fare rate for Fourth of July excursions in association territory within a radius of 200 miles from initial point of ticket, except that rates between points in Michigan shall be 1½ cents per mile, short line mileage, tickets to be good going July 3 and 4, and returning not later than July 5 at initial point. Some of the roads favor extending these limits, but others object on the ground that to do so will interfere with other rates.

A proposition has been submitted to the other interested lines by the Gulf, Colorado & Santa Fe to reduce present World's Fair rates from Texas points, on the ground that the rates as now established are too high and will not properly stimulate this business.

Central Traffic lines have reaffirmed their position that pending an agreement with the Trans-Continental lines for through rates and divisions on that traffic through bills of lading will not be issued on westbound traffic, but that local rates will be exacted to all junction points with Western roads, except that through bills of lading may be issued at the sums of the locals both east and west of junction points. No through rates or divisions will be protected eastbound except such as have been approved by the Association or in cases where the proportion accruing to the eastern lines exceeds the locals.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending June 17 amounted to 59,670 tons, against 61,647 tons during the preceding week, a decrease of 1,977 tons, and against 56,122 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to June 17.		W'k to June 10	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	7,657	12.8	6,982	11.3
Wabash	3,773	6.3	3,573	5.8
Lake Shore & Michigan South.	12,101	20.3	12,030	19.5
Pitts., Ft. Wayne & Chicago.	8,308	13.9	9,054	14.7
Pitts., Cin., Chicago & St. Louis	6,335	10.6	7,114	11.6
Baltimore & Ohio	3,811	6.4	2,792	4.5
Chicago & Grand Trunk	3,387	5.7	3,976	6.5
New York, Chic. & St. Louis	5,298	8.9	5,773	9.4
Chicago & Erie	6,566	11.0	7,939	12.8
C., C., C. & St. Louis	2,134	4.1	2,414	3.9
Totals	59,670	100.0	61,647	100.0

Of the above shipments 1,783 tons were flour, 27,148 tons grain and millstuff, 8,355 tons cured meats, 10,683 tons dressed beef, 2,025 tons butter, 2,076 tons hides and 6,479 tons lumber. The three Vanderbilt lines carried 42 per cent., the two Pennsylvania lines 24.5 per cent. The Lake lines carried 92,481 tons, against 104,359 tons during the preceding week, a decrease of 11,878 tons.

Other Chicago traffic news will be found on page 484.